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ABSTRACT

This question book was developed by the Federal Aviation Administration (FAA) to be used by FAA testing centers and FAA-designated written test examiners when administering the flight engineer written test. The book can be used to test applicants in the following flight engineer knowledge areas: basic, turbojet powered, turbopropeller powered, and reciprocating engine powered. The multiple-choice test questions in this book represent a departure from referencing specific airplane makes and models. Instead, test questions are referenced from readily available publications using general questions common to the operation of most turbojet, turbopropeller, and reciprocating engines. Extensive appendices contain background material needed to answer the questions, including 58 figures. (Answers to the questions are not included, nor are they published by the FAA.) (KC)

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# FLIGHT ENGINEER QUESTION BOOK

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Expires September 1, 1991

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# FLIGHT ENGINEER

# QUESTION BOOK

1989

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Aviation Standards National Field Office

3

# PREFACE

This question book has been developed by the Federal Aviation Administration (FAA) to be used by FAA testing centers and FAA designated written test examiners when administering the flight engineer written test.

This question book is for use in testing applicants in the following knowledge areas:

Flight Engineer—Basic
Flight Engineer—Turbojet Powered
Flight Engineer—Turbopropeller Powered
Flight Engineer—Reciprocating Engine Powered

An applicant for a flight engineer certificate must pass a basic written test and a class rating written test appropriate to the aircraft class for which a rating is desired.

The flight engineer class test questions in this question book represent a departure from referencing specific airplane makes and models. Instead, class test questions are referenced from readily available publications utilizing general-type questions common to the operation of most turbojet, turbopropeller, and reciprocating engines.

This question book is issued as FAA-T-8080-8C, Flight Engineer Question Book, and is available to the public from:

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Washington, DC 20402

or from U.S. Government Printing Office bookstores located in major cities throughout the United States.

The questions included in this publication are predicated on regulations, references, principles, and practices that were valid at the time of publication. The question selection sheets prepared for use with this question book are security items and are revised at frequent intervals.

The FAA does NOT publish, supply, or make available, the correct answers to questions included in this question book. Students should determine the correct answers through research and study of appropriate subject material, working with instructors, and by attending appropriate ground schools. The FAA is NOT responsible for the content of commercial reprints of this question book, or the accuracy of any answers supplied separate or inclusive.

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# GENERAL INSTRUCTIONS

## *MAXIMUM TIME ALLOWED FOR TEST: 6 HOURS*

### TEST MATERIALS

Materials to be used with this question book when used for airman testing:

1. AC Form 8080-3, Airman Written Test Application, which includes the answer sheet.
2. Question selection sheet which identifies the questions to be answered.
3. Plastic overlay sheet which can be placed over performance charts for plotting purposes.

### TAKING THE TEST

1. Read the instructions on page 1 of AC Form 8080-3, and complete page 4 of the form.
2. The question numbers in the question book are numbered consecutively beginning with number 8001. Refer to the question selection sheet to determine which question to answer.
3. For each item on the answer sheet, find the appropriate question in the question book.
4. Mark your answer in the space provided for that item on the answer sheet.
5. Read each question carefully and avoid hasty assumptions. Do not answer until you understand the question. Do not spend too much time on any one question. Answer all the questions that you readily know and then reconsider those you find difficult. Be careful to make necessary conversions when working with temperatures, speeds, and distances.

If a regulation, chart, or operations procedure is changed after this question book is printed, you will receive credit for the affected question until the next question book revision.

Comments regarding this publication should be directed to:

U.S. Department of Transportation
Federal Aviation Administration
Aviation Standards National Field Office
Examinations Standards Branch
Operations Standards Section, AVN-131
P.O. Box 25082
Oklahoma City, OK 73125

## *THE MINIMUM PASSING GRADE IS 70*

# WARNING

**§ 63.18 Written tests: Cheating or other unauthorized conduct.**

(a) Except as authorized by the Administrator, no person may—

(1) Copy, or intentionally remove, a written test under this part;

(2) Give to another, or receive from another, any part or copy of that test;

(3) Give help on that test to, or receive help on that test from, any person during the period that test is being given;

(4) Take any part of that test in behalf of another person;

(5) Use any material or aid during the period that test is being given; or

(6) Intentionally cause, assist, or participate in any act prohibited by this paragraph.

(b) No person whom the Administrator finds to have committed an act prohibited by paragraph (a) of this section is eligible for any airman or ground instructor certificate or rating, or to take any test therefore, under this chapter for a period of 1 year after the date of that act. In addition, the commission of that act is a basis for suspending or revoking any airman or ground instructor certificate or rating held by that person.

# INTRODUCTION TO THE FLIGHT ENGINEER QUESTION BOOK

This question book presents the FAA flight engineer written tests. Applicants for flight engineer certificates must pass a Basic Written Test and a Class Rating Written Test appropriate to the class of aircraft for which a rating is desired.

The Flight Engineer Basic Written Test consists of questions over subject areas pertaining to:

- Federal Aviation Regulations (FAR's) appropriate to a flight engineer.
- Theory of flight and aerodynamics.
- Basic meteorology with respect to engine operations.
- Center of gravity computations.

The Class Rating Written Test consists of questions over subject areas pertaining to:

- Preflight.
- Airplane equipment.
- Airplane systems.
- Airplane loading.
- Airplane procedures and engine operations and limitations.
- Normal operating procedures.
- Emergency procedures.
- Mathematical computation of engine operations and fuel consumption.

The three class rating tests include turbojet, turboprop, and reciprocating engines. The class rating tests are each based on operation of the appropriate powerplant installation as typically found in the preponderance of large transport-type aircraft requiring a flight engineer crewmember.

Question selection sheets are used in conjunction with this question book to administer the proper written test to each applicant. Each test is constructed from the questions included in this question book.

This question book is scheduled for revision each 24 months. Associated question selection sheets will be revised periodically as required.

## *TEST PREPARATION*

The applicant should become familiar with the knowledge requirements found in FAR Part 63, Subpart B, Flight Engineers.

Sufficient preparatory and study materials applicable to the Flight Engineer Basic Written Test can be found in government publications which include:

- AC 00-2, Advisory Circular Checklist
- AC 00-6, Aviation Weather
- AC 61-21, Flight Training Handbook
- AC 61-23, Pilot's Handbook of Aeronautical Knowledge
- AC 61-27, Instrument Flying Handbook
- AC 91-23, Pilot's Weight and Balance Handbook
- Code of Federal Regulations (CFR), Parts 1 through 199
- Airman's Information Manual (AIM)
- Aerodynamics for Naval Aviators (NAVWEPS)

Sufficient preparatory and study materials applicable to the Flight Engineer Airplane Written Class Test can be found in government publications which include:

- AC 00-2, Advisory Circular Checklist
- AC 65-9, Airframe and Powerplant Mechanics - General Handbook
- AC 65-12, Airframe and Powerplant Mechanics - Powerplant Handbook
- AC 65-15, Airframe and Powerplant Mechanics - Airframe Handbook
- AC 91-23, Pilot's Weight and Balance Handbook
- Code of Federal Regulations (CFR), Parts 1 through 199
- Aerodynamics for Naval Aviators (NAVWEPS)

The applicant is encouraged to prepare and utilize a lesson plan that will address the required subject knowledge areas specified in FAR Part 63, Subpart B. In addition, applicants are encouraged to seek instruction from competent instructors and ground schools.

### *Testing*

The written test may be taken at FAA testing centers, FAA written test examiner's facilities, or other designated places.

The applicant is issued a "clean copy" of this question book, an appropriate question selection sheet indicating the specific questions to be answered, and AC Form 8080-3 which includes the answer sheet. The question book contains all supplementary material required to answer the questions. Supplementary materials are located in appendix 2.

Read the directions carefully before beginning the test. Incomplete or erroneous information delays the scoring process. Test questions are of the multiple-choice type. Answers to the test questions listed on the question selection sheet should be marked on the answer sheet portion of AC Form 8080-3.

Upon completion of the test, the answer sheet is sent to the Mike Monroney Aeronautical Center in Oklahoma City, Oklahoma, where it is scored by computer. The applicant is then issued an AC Form 8080-2, Airman Written Test Report. This form will list the test score and subject matter knowledge codes referencing the subjects in which the applicant is deficient.

The written test subject matter knowledge codes are then matched to the corresponding subject matter knowledge areas published in appendix 1 of this question book. The applicant should review those subject areas until proficient.

The applicant should be aware that each subject area on AC Form 8080-2 appears only once even though more than one question may have been missed in that subject area. Therefore, the number of subject areas reflected on AC Form 8080-2 is not representative of the number of questions missed on the examination.

Retain AC Form 8080-2 to be presented for the practical test, or for retesting in the event of written test failure.

When taking the test, the applicant should keep the following points in mind:

1. Answer each question in accordance with the latest regulations and procedures.
2. Read each question carefully before looking at the possible answers. You should clearly understand the problem before attempting to solve it.
3. After formulating an answer, determine which of the alternatives most nearly corresponds with that answer. The answer chosen should completely resolve the problem.
4. From the answers given, it may appear that there is more than one possible answer; however, there is only one answer that is correct and complete. The other answers are either incomplete or are derived from popular misconceptions.
5. If a certain question is difficult for you, it is best to proceed to other questions. After the less difficult questions have been answered, return to those which gave you difficulty. Be sure to indicate on your question selection sheet the questions to which you wish to return.
6. When solving a computer problem, select the answer nearest your solution. The problem has been checked with various types of computers; therefore, if you have solved it correctly, your answer will be closer to the correct answer than to any of the other choices.
7. To aid in scoring, enter personal data in the appropriate spaces on the test answer sheet in a complete and legible manner. Be sure to enter the test number exactly as printed on the question selection sheet.

### *Retesting—FAR Section 63.41*

An applicant for a Flight Engineer Certificate who fails a written test or practical test for that certificate may apply for retesting—

1. after 30 days after the date the applicant failed that test; or
2. after the applicant has received additional practice or instruction (flight, synthetic trainer, or ground training, or any combination thereof) that is necessary in the opinion of the Administrator or the applicant's instructor (if the Administrator has authorized the instructor to determine the additional instruction necessary) to prepare the applicant for retesting.

The AC Form 8080-2 must be presented for the practical test, or for retesting in the event of written test failure.

# QUESTIONS

**8001.** According to the FAR's, which of the following defines flight crewmember?

1—Any person, including a flight attendant, assigned to duty in an aircraft during flight time.
2—A certificated airman assigned to flight deck duty during flight time.
3—A pilot, flight engineer, or flight navigator assigned to duty in an aircraft during flight time.
4—A pilot or flight engineer assigned to flight deck duty but no other air carrier employees.

**8002.** What is the definition of the term critical engine?

1—The outboard engine on the right side.
2—The engine whose failure would most adversely affect airplane performance or handling qualities.
3—The engine which carries the greatest accessory load during takeoff.
4—Either outboard engine.

**8003.** Which class of material will not propagate a flame, beyond safe limits, after the ignition source is removed?

1—Flash resistant.
2—Fireproof.
3—Flammable.
4—Flame resistant.

**8004.** A material which is not susceptible to burning violently when ignited is defined as

1—flame resistant.
2—fireproof.
3—flash resistant.
4—nonflammable.

**8005.** Which altitude is the highest at which an engine can maintain a rated continuous manifold pressure at maximum continuous rotational speed?

1—Rated altitude.
2—Critical altitude.
3—Service ceiling.
4—Absolute ceiling.

**8006.** The term fireproof indicates that the material can withstand the heat of a fire at least as well as which other material?

1—Aluminum alloy.
2—Asbestos.
3—Steel.
4—Titanium.

**8007.** What is a definition of the term crewmember relative to provisions of the FAR's?

1—United States citizens assigned to duty on an air carrier engaged in international air commerce.
2—Only a pilot, flight engineer, or flight navigator assigned to duty in an aircraft during flight time.
3—A person assigned to perform duty in an aircraft during flight time.
4—Any person assigned to duty in an aircraft during flight except a pilot or flight engineer.

**8008.** (Refer to figure 1.) At what location(s) will you find a yellow indicator disc?

1—A only.
2—B and C.
3—D and E.
4—H only.

**8009.** (Refer to figure 1.) On a turbojet fire extinguishing system, where will a red indicator disc be found?

1—B and C.
2—A, B, and C.
3—D and E.
4—F and G.

**8010.** (Refer to figure 1.) Where, in the fire extinguishing system, will you find the fire bottle pressure indicated?

1—D and E.
2—B and C.
3—A only.
4—H only.

**8011.** (Refer to figure 1.) A red disc is missing from port C, and a yellow disc is missing from port A. What does this indicate?

1—Bottle 1 has been normally discharged and bottle 2 has experienced thermal discharge.
2—Bottle 2 has been normally discharged and bottle 1 has experienced thermal discharge.
3—Both bottles have been thermal discharged.
4—Both bottles have been normally discharged, but into different engines.

**8012.** (Refer to figure 1.) No. 2 fire bottle is discharged into No. 1 engine. What indicates this has occurred?

1—Missing yellow disc at position A, and zero pressure reading at position D.
2—Missing yellow disc at position A, and missing red disc at position B.
3—Yellow discs missing from positions B and C, and a red disc showing at position A.
4—Zero pressure reading at position E, and a missing yellow disc at position A.

**8013.** (Refer to figures 1 and 2.) After discharging the second of two containers of extinguishing agent into engine No. 3, where will the fire switches be positioned and what indications will be noted on the discharged fire bottles?

1—Right system transfer switch "NORMAL" and two yellow discs showing on the bottle discharge indicator ports.
2—Right system transfer switch "TRANS" and a yellow disc missing from the bottle discharge indicator port.
3—Left system transfer switch "TRANS" and two red discs showing on the bottle safety discharge ports.
4—Both left and right transfer switches "TRANS" and two red discs missing from the bottle safety discharge ports.

**8014.** (Refer to figures 1 and 2.) You have discharged No. 1 fire bottle into No. 1 engine. Which system transfer switch positions and fire bottle indications will then be observed?

1—Left system transfer switch "TRANS" and a missing red disc at the No. 1 fire bottle safety discharge port.
2—Left system transfer switch "NORMAL" and a yellow disc missing at the No. 1 fire bottle safety discharge port.
3—Left system transfer switch "NORMAL" and a yellow disc missing at the fire bottle discharge indicator port.
4—Right system transfer switch "TRANS" and a red disc missing at the fire bottle safety discharge port.

**8015.** (Refer to figure 2.) Following a fire warning, you have discharged a container of fire extinguishing agent into engine No. 4. If needed, how would you direct another container of extinguishing agent into engine No. 4?

1—Select the left system transfer switch "TRANS," and push No. 4 discharge switch.
2—Place the left system transfer switch in "TRANS," and push either No. 1 or No. 2 discharge switches.
3—Right system transfer switch "TRANS," and push discharge switch No. 3.
4—Right system transfer switch "TRANS," and push discharge switch No. 4.

**8016.** (Refer to figure 2.) After discharging a container of extinguishing agent into engine No. 1, you determine a second container is also needed. What procedure would you use to direct the second container into engine No. 1?

1—Left system transfer switch "TRANS" and push discharge switch No. 1.
2—Left system transfer switch "NORMAL," right system transfer switch "TRANS," and push discharge switch No. 1.
3—Right system transfer switch "TRANS," left system transfer switch "TRANS," and push either discharge switch No. 3 or No. 4.
4—Left system transfer switch "TRANS," right system transfer switch "NORMAL," and push either discharge switch No. 3 or No. 4.

**8017.** Which speed symbol is correctly defined?

1—$V_{MF}$ means maximum flap extended speed.
2—$V_{LE}$ means maximum landing gear operating speed.
3—$V_{SO}$ means minimum steady flight speed in landing configuration.
4—$V_{MO}$ means minimum control speed with the critical engine inoperative.

**8018.** Which speed symbol is correctly defined?

1—$V_{MC}$ means the minimum control speed with No. 1 engine inoperative.
2—$V_{LO}$ means the maximum speed for operation with the landing gear extended.
3—$V_F$ means the maximum speed with flaps in the extended position.
4—$V_1$ means takeoff decision speed.

**8019.** Which speed symbol is correctly defined?

1—$V_{MF}$ means maximum flap extended speed.
2—$V_{LE}$ means maximum landing gear operating speed.
3—$V_{MO}$ means minimum control speed with the critical engine inoperative.
4—$V_S$ means the stalling speed or the minimum steady flight speed at which the airplane is controllable.

**8020.** Which is a definition of $V_2$ speed?

1—Speed for the best rate of climb.
2—Takeoff decision speed.
3—Takeoff safety speed.
4—Minimum takeoff speed.

**8021.** Which current certificates must a flight crewmember possess to act as a flight engineer on a DC-10 aircraft in passenger service for a domestic U.S. air carrier?

1—Flight Engineer Certificate with appropriate rating or a Commercial Pilot Certificate with instrument rating and a Second-Class Medical Certificate.
2—Flight Engineer Certificate with appropriate rating or a foreign flight engineer license and a Second- or Third-Class Medical Certificate.
3—Flight Engineer Certificate with DC-10 rating and a First- or Second-Class Medical Certificate.
4—Flight Engineer Certificate with turbojet rating and a Second-Class (or higher) Medical Certificate.

**8022.** The possession of which combination of certificates permits an airman to perform as a flight engineer?

1—A Commercial Pilot Certificate with instrument rating and a Second-Class Medical Certificate.
2—A special purpose Flight Engineer Certificate and Third-Class Medical Certificate.
3—A temporary medical certificate and a limited Flight Engineer Certificate.
4—A temporary Flight Engineer Certificate and a Second-Class Medical Certificate.

**8023.** Which current certificates must a flight crewmember possess to act as a flight engineer on an L-188 aircraft in passenger service for a domestic U.S. air carrier?

1—Flight Engineer Certificate with appropriate rating, or a foreign flight engineer license and a Second- or Third-Class Medical Certificate.
2—Flight Engineer Certificate with appropriate rating, or a Commercial Pilot Certificate with instrument rating and a Second-Class Medical Certificate.
3—Flight Engineer Certificate with an L-188 rating, and a First- or Second-Class Medical Certificate.
4—Flight Engineer Certificate with turbopropeller rating, and a First- or Second-Class Medical Certificate.

**8024.** What is the last date an airman may have performed as a required flight engineer on a domestic air carrier if the engineer's second-class physical examination was conducted on March 15, 1986?

1—March 31, 1987.
2—March 15, 1987.
3—September 15, 1986.
4—March 31, 1988.

**8025.** What restriction is placed upon a flight engineer during the period in which the Flight Engineer Certificate is suspended?

1—May not take a written test at an FAA office.
2—May not act as a pilot if a valid Commercial Pilot Certificate is possessed.
3—May not apply for a rating to be added to the Flight Engineer Certificate.
4—May not apply for a pilot, mechanic, or ground instructor certificate.

**8026.** During the period a Flight Engineer Certificate is suspended by the FAA, a certificated flight crewmember may not (without special FAA authorization)

1—take a written test at an FAA office.
2—exercise the privileges of a Commercial Pilot Certificate in passenger flight operation under FAR Part 121.
3—apply for any certificate issued by the FAA.
4—have a rating added to the certificate.

**8027.** Unless the order of revocation provides otherwise, a person whose Flight Engineer Certificate is revoked may not apply for the same kind of certificate for what period of time?

1—30 days after the date of revocation.
2—90 days after the date of revocation.
3—6 months after the date of revocation.
4—1 year after the date of revocation.

**8028.** (Refer to figure 3.) What affect will a headwind component of 15 knots have upon an airplane landing at a speed of 150 knots?

1—Landing distance is increased 28 percent.
2—Landing distance is decreased 23 percent.
3—Landing distance will decrease 28 percent.
4—Landing distance will not be affected, only groundspeed.

**8029.** (Refer to figure 3.) Takeoff speed is 130 knots. With a 10 knot tailwind, how will the takeoff distance be affected?

1—Takeoff distance will be increased 27 percent more than under no-wind conditions.
2—Takeoff distance will be 24 percent shorter than normal due to the tailwind affect.
3—No change in takeoff distance because groundspeed and airspeed are the same until airborne.
4—Takeoff distance will decrease 27 percent over normal.

**8030.** (Refer to figure 3.) If normal takeoff distance is 3,180 feet with an indicated takeoff speed of 118 knots, what will be the effect of an 18 knot headwind component?

1—Takeoff speed will increase to 136 knots.
2—Takeoff distance will decrease to 2,290 feet.
3—Takeoff speed will decrease to 100 knots.
4—Takeoff distance will increase to 3,657 feet.

**8031.** (Refer to figure 3.) Normal calm wind landing distance is 4,430 feet with a landing speed of 135 knots. What is the landing distance with a 5 knot tailwind condition?

1—4,253 feet.
2—3,987 feet.
3—4,873 feet.
4—4,607 feet.

**8032.** (Refer to figure 3.) Which is correct concerning a takeoff speed of 122 knots with a 10-knot tailwind?

1—Both takeoff airspeed and distance will decrease 16.5 percent.
2—Required takeoff airspeed will increase 16.5 percent.
3—Required takeoff distance will increase 16.5 percent.
4—Both takeoff airspeed and distance will increase 16.5 percent.

**8033.** (Refer to figure 3.) Which is correct with regard to landing with a 19 knot headwind with a landing speed of 141 knots?

1—Required landing distance will decrease 25 percent and landing speed will remain the same.
2—Reference landing speed will increase to 160 knots, and landing distance will remain the same.
3—Required landing distance will increase 25 percent and the required landing speed will remain the same.
4—Reference landing speed will decrease to 122 knots and landing distance will decrease 19 percent.

**8034.** A temporary certificate issued to a qualified flight engineer applicant, pending review of his/her application, is effective for what maximum period of time?

1—30 days.
2—60 days.
3—90 days.
4—120 days.

**8035.** Which of the following is grounds for the revocation of a Flight Engineer Certificate by the FAA?

1—Transportation of depressant or stimulant drugs.
2—Failure to pass a first- or second-class medical examination every 12 months.
3—Conviction on any charge of misdemeanor.
4—Failure to reapply for Flight Engineer Certificate renewal before the 24-month expiration date.

**8036.** Unless suspended or revoked, a Flight Engineer Certificate

1—expires at the end of the 24th month following the month of issuance or renewal.
2—expires the same date as the expiration of the required First-Class Medical Certificate.
3—expires 1 year after the month of issuance.
4—is issued without a specific expiration date.

**8037.** Conviction of any Federal or state statute relating to disposition, possession, or transportation of narcotic drugs is grounds for suspension

1—of certificate privileges, only if an airplane was involved.
2—of certificate privileges, but only if FAR's were violated.
3—or revocation of only certificates held prior to the conviction date.
4—or revocation of any certificate held, or denial of any future application for 1 year from date of conviction.

**8038.** An airman has lost a Flight Engineer Certificate document. The privileges of the certificate may be exercised when possessing a

1—confirming telegram from the FAA.
2—valid medical certificate but only for a period of 120 days.
3—copy of a passing written test grade report.
4—temporary certificate issued by a designated flight engineer examiner.

**8039.** Which procedure applies for a flight engineer with an increase in physical deficiency beyond the limits of the standards of the medical certificate as outlined in FAR Part 67? The engineer

1—must have a recheck by an FAA medical examiner.
2—may not legally perform flight engineer duties.
3—may continue to perform as a flight engineer until the expiration date of the medical certificate.
4—must return (surrender) the medical certificate to an FAA inspector.

**8040.** Refusal by a flight engineer to submit to an alcohol test, when requested by a law enforcement officer, is grounds for

1—revocation of any certificate regardless of the reason for the test request.
2—revocation of any certificate or rating issued under FAR Part 63, if the refusal is related to alcohol or drug use by a crewmember.
3—denial of any future application for a certificate or rating.
4—revocation of all certificates and denial of any new applications for 5 years following the date of conviction for an alcohol-related offense.

**8041.** Which is grounds for revoking a flight engineer's certificate?

1—Flying 1,200 hours in 12 calendar months but logging only 1,000 hours.
2—Failure of a recurrent emergency procedures flight test.
3—Operating during a physical deficiency.
4—Alteration of the certificate.

**8042.** How long may a flight engineer use a telegram in lieu of a lost or destroyed medical certificate?

1—30 days.
2—60 days.
3—90 days.
4—120 days.

**8043.** (Refer to figure 4.) Engine pressure ratio (EPR) measurement in a two-spool axial flow turbojet engine is the differential between

1—A only and ambient pressure.
2—A and B.
3—A and C.
4—A and D.

**8044.** (Refer to figure 4.) Engine pressure ratio (EPR) measurement in a single-spool axial flow turbojet engine is the differential between

1—A and B.
2—A and C.
3—A and D.
4—A only and exhaust pressure.

**8045.** (Refer to figure 4.) In a two-spool axial flow turbine engine, what identifier is given to turbine discharge total pressure?

1—Pt2.
2—Pt5.
3—Pt7.
4—Pt9.

**8046.** (Refer to figure 4.) What input data is obtained from position A?

1—Compressor inlet total pressure.
2—Turbine discharge pressure.
3—Airspeed raw data.
4—Engine pressure ratio (EPR).

**8047.** (Refer to figure 4.) What measurement would be obtained by comparing data from position A and position C in a turbojet engine?

1—Engine pressure ratio (EPR) of a single spool axial flow compressor.
2—Turbine inlet temperature.
3—Engine pressure ratio (EPR) of a two-spool engine.
4—True airspeed adjusted for ram effect.

**8048.** (Refer to figure 4.) What information would be obtained from readings obtained from positions A and B?

1—Exhaust temperature rise through the burners.
2—Engine pressure ratio of a single spool engine.
3—Engine pressure ratio of a dual spool axial flow engine.
4—Exhaust pressure ratio of a single spool engine.

**8049.** A flight engineer who has completed all of the required written tests and completed the practical test in a DC-8 is entitled to which aircraft class rating?

1—Turbojet-powered.
2—DC-8.
3—Three-engine jet.
4—Turbojet, three or more engines.

**8050.** Which constitutes a class rating for a Flight Engineer Certificate?

1—Airplane.
2—Turbopropeller-powered.
3—Rotorcraft.
4—Multiengine-powered.

**8051.** A flight engineer who wants to add an additional class rating to his/her certificate must pass

1—the appropriate basic and airplane written tests for each airplane to be flown.
2—the appropriate combined written test applicable to the desired class rating.
3—a written and practical test appropriate to the class rating being sought.
4—only oral and practical tests over the systems on the aircraft for which the class rating is being sought.

**8052.** Which is an eligibility requirement for the issuance of a Flight Engineer Certificate by the FAA?

1—Hold a Second- or Third-Class Medical Certificate.
2—Be 21 years of age or older.
3—Be a citizen of the United States.
4—Have a fluent command of the English language.

**8053.** To be eligible for a Flight Engineer Certificate, with no limitations, a person must

1—hold a First-Class Medical Certificate issued no later than 6 months prior to the date of application.
2—pass a written test on airplane procedures and operations of reciprocating and jet aircraft engines.
3—hold either a pilot certificate or mechanic certificate.
4—be able to read, speak, and understand the English language.

**8054.** To be eligible for a Flight Engineer Certificate, a person must

1—pass a written test on airplane procedures and operations of reciprocating- and jet-powered engines.
2—hold a First- or Second-Class Medical Certificate issued within the 12 months before the date of application.
3—be able to read, speak, and write the English language.
4—be the holder of a pilot certificate or mechanic certificate.

**8055.** Which is an aircraft class rating appropriate for a Flight Engineer Certificate?

1—Multiengine land.
2—Propeller-driven.
3—Turbojet-powered.
4—Three- or four-engine, fanjet.

**8056.** Which is an aircraft class rating appropriate for a Flight Engineer Certificate?

1—Jet-powered.
2—Multiengine.
3—Turbopropeller-powered.
4—Transport.

**8057.** The pilot-in-command or second-in-command time used to satisfy the aeronautical experience requirements for the Flight Engineer Certificate must have been obtained on

1—a four-engine aircraft.
2—at least a three-engine transport, if turbojet-powered.
3—an airplane on which a flight engineer is required.
4—a transport category airplane or equivalent military airplane.

**8058.** (Refer to figure 5.) What is the distance in feet of radius A?

1—25 feet.
2—50 feet.
3—75 feet.
4—100 feet.

**8059.** (Refer to figure 5.) Indicate the width of the jet wake danger area at location C.

1—30 feet.
2—60 feet.
3—90 feet.
4—120 feet.

**8060.** (Refer to figure 5, item B.) What distance can the exhaust jet wake danger area extend behind an operating turbofan engine?

1—200 feet.
2—160 feet.
3—120 feet.
4—80 feet.

**8061.** Which minimum aeronautical experience qualifies an applicant to obtain a Flight Engineer Certificate with a class rating?

1—At least 24 months of practical experience in aircraft and engine repair.
2—200 hours of flight time as a pilot in command in a transport category airplane.
3—At least 50 hours as a flight engineer on the same class airplane for which the rating is sought.
4—Within 60 days prior to application, successful completion of an approved flight engineer ground school.

**8062.** The carriage of cargo aft of the rearmost seated passengers in the passenger compartment is

1—not permissible.
2—permissible only if the cargo is carried in an approved cargo bin.
3—permissible if carried in a cargo bin secured to the floor.
4—not permissible if the aircraft is used on a domestic or flag carrier route.

**8063.** Any piece of cargo or carry-on baggage in the passenger compartment ahead of the foremost seated passengers must be

1—packaged to avoid possible injury to passengers.
2—secured with an approved cargo net.
3—placed in a passenger seat with a seatbelt.
4—carried in an approved cargo bin.

**8064.** Which of the following rules apply when cargo is carried in the passenger compartment ahead of the foremost seated passengers?

1—The cargo must be secured to the floor with tiedown straps.
2—The cargo must be carried forward of a bulkhead or divider.
3—The cargo must be in a passenger seat and secured.
4—The cargo must be carried in approved cargo bins.

**8065.** Cargo in the passenger compartment may be carried in approved cargo bins if located

1—in an area above the passenger seats.
2—in a passenger seat.
3—forward of the foremost seated passengers.
4—anywhere in the passenger compartment.

**8066.** An aural landing gear warning device, which operates in relation to flap position,

1—may have a manual shutoff located at the pilot or flight engineer station.
2—may be used instead of a throttle actuated warning device.
3—must have the flap position sensor located on the flap selector cable.
4—must sound continuously when the flaps are extended beyond the maximum approach climb configuration if the gear is not down and locked.

**8067.** The calibration of each airspeed indicator, each airspeed limitation, and each item of related information in the airplane flight manual or on pertinent placards must be expressed in

1—equivalent airspeed.
2—statute miles per hour.
3—knots.
4—percent of Mach.

**8068.** Information obtained from flight data and cockpit voice recorders shall be used only for determining

1—maintenance problems associated with the cockpit checklist.
2—who was responsible for any accident or incident.
3—evidence for use in civil penalty or certificate action.
4—possible causes of accidents or incidents.

**8069.** For what purpose may information obtained from cockpit voice recorders and flight data recorders not be used?

1—Determining causes of accidents and occurrences under investigation by the NTSB.
2—Identifying malfunctions and irregularities in aircraft systems.
3—Determining any certificate action or civil penalty arising out of an accident or occurrence.
4—Identifying procedures that may have been conducive to any accident or occurrence resulting in investigation under NTSB Part 830.

**8070.** In the event of an accident or occurrence requiring immediate notification of the NTSB, the operator shall keep flight recorder and cockpit voice recorder data for at least

1—30 days.
2—60 days.
3—90 days.
4—120 days.

**8071.** How long shall cockpit voice recorder and flight recorder data be kept, in the event of an accident or occurrence resulting in termination of the flight?

1—30 days.
2—60 days.
3—90 days.
4—120 days.

**8072.** (Refer to figure 6.) How will instruments D and H be affected if pitot tube A becomes iced over?

1—D will become inoperative and H will not be affected.
2—H will be inoperative, but D will not be affected.
3—Neither D or H will be affected.
4—Both D and H will be rendered inoperative.

**8073.** (Refer to figure 6.) In the event static port S becomes plugged, which instruments will be affected if no alternate static selections are made?

1—G, H, and I, only.
2—F, G, H, and I, only.
3—F and G only.
4—F, G, and J, only.

**8074.** (Refer to figure 6.) Captain's instruments B and C become inoperative due to a blockage at A. If auxiliary position T is selected on the First Officer's panel, how will instruments B and C be affected?

1—B and C will remain inoperative.
2—B and C will be operating by input from position Q.
3—B and C will be operating by input from position K.
4—B and C will become operative.

**8075.** (Refer to figure 6.) Should cabin differential pressure N become locked due to a blockage at the auxiliary static port, what corrective action would restore operation?

1—No action need be taken as the Captain's system will automatically compensate.
2—No action need be taken as the First Officer's system will automatically compensate.
3—Either the Captain or First Officer system can supply input through selector valves.
4—The Auxiliary position is independent from the other positions, therefore, the cabin differential pressure will remain frozen and must be operated manually.

**8076.** On airplanes requiring a third gyroscopic bank-and-pitch indicator, which is a requirement with regard to the instrument or system's operation?

1—Operation must be dependent on the captain's attitude indicating system.
2—The power source must provide reliable operation for 30 minutes after total failure of the electrical generating system.
3—The power source must be manually selected to prevent an inadvertent failure during an automatic power transfer.
4—The power source must provide reliable operation for the duration of the flight after failure of the alternating current electrical system.

**8077.** On large turbojet aircraft, a third artificial horizon indicating system must be installed. Which is an operational requirement of this system?

1—It must be powered from the main electrical generating system.
2—Operation must be in conjunction with one of the other attitude indicating systems.
3—Reliable indication must be presented for 15 minutes after its source of power fails.
4—It must be operational without selection after failure of the electrical generating system.

**8078.** A crewmember interphone system is required on which airplane?

1—A large airplane.
2—An airplane with more than 19 passenger seats.
3—A turbojet airplane.
4—An airplane that operates above FL250.

**8079.** Which airplanes must be equipped with flight recorders?

1—Airplanes that carry more than 19 passengers.
2—All airplanes operating under FAR Part 125.
3—All airplanes flying above FL240.
4—All large, turbine engine powered airplanes.

**8080.** Where should the portable battery-powered megaphone be located if only one is required on a passenger carrying airplane?

1—The most rearward location in the passenger cabin.
2—The most forward location in the passenger cabin.
3—In the passenger cabin near the overwing emergency exit.
4—On the flight deck, readily accessible to the flight crewmembers.

**8081.** During preflight inspection, the flight engineer finds that one hand fire extinguisher is missing in the passenger cabin. Which factor determines the minimum number of hand fire extinguishers required for flight under FAR Part 121?

1—Number of passengers aboard.
2—Number of required crewmembers.
3—Number of installed passenger seats.
4—Type of cabin wall lining and upholstery material.

**8082.** How many portable battery-powered megaphones are required on an air carrier airplane with a seating capacity of 150 passengers on a trip segment when 75 passengers are carried? (FAR Part 121.)

1—Two; one located near or accessible to the flightcrew, and one located near the center of the passenger cabin.
2—One at the most rearward location in the passenger cabin.
3—One located near the center of the passenger cabin.
4—Two; one at the forward end, and the other at the most rearward location of the passenger cabin.

**8083.** An airplane used in domestic air carrier operations has a seating capacity for 65 passengers. What is the minimum number of fire extinguishers and megaphones which must be located in the cabin when 55 passengers are carried? (FAR Part 121.)

1—Two hand fire extinguishers and two megaphones.
2—One hand fire extinguisher and two megaphones.
3—Two hand fire extinguishers and one megaphone.
4—Three hand fire extinguishers and one megaphone.

**8084.** When a second portable megaphone is required aboard an air carrier airplane, where will it be located?

1—At the most rearward location in the passenger compartment.
2—At the forward end of the passenger compartment.
3—On the flight deck.
4—Adjacent to an emergency exit.

**8085.** (Refer to figure 7.) How would you identify the mixture control on the power quadrant of a large transport-type airplane?

1—C and color coded red.
2—A and color coded red.
3—A and color coded black.
4—E and color coded blue.

**8086.** (Refer to figure 7.) Which control would you select to increase the throttle setting?

1—Black knob D.
2—Black knob B.
3—Red knob C.
4—Blue knob A.

**8087.** (Refer to figure 7.) Movement of the blue knob on the quadrant mounted controls would change the position of knob

1—E.
2—A.
3—B.
4—C.

**8088.** Which requirement applies to emergency equipment (fire extinguishers, megaphones, first aid kits, and crash ax) installed in an air carrier airplane?

1—Cannot be located on the flight deck, all must be located in the passenger compartment.
2—Cannot be located in a compartment or area where it is not immediately visible to a flight attendant in the passenger compartment.
3—Must be clearly marked to indicate its method of operation.
4—Must be replaced every 6 months to reduce possibilities of failure when needed.

**8089.** Which event must cause the lighting of interior emergency exit lights?

1—Opening of the emergency exit.
2—Actuation of the emergency exit by external power.
3—Interruption of the airplane's normal electric power.
4—Interruption of the airplane's electro-hydraulic power system.

**8090.** If there is a required emergency exit located in the flightcrew compartment, the door which separates the compartment from the passenger cabin shall

1—not be locked during flight.
2—be locked at all times except during emergency landings.
3—be locked at all times except during any emergency declared by the pilot in command.
4—not be locked during takeoff and landing.

**8091.** Interior emergency exit lights should be checked for operation. FAR's require that these lights must

1—operate automatically when subjected to a negative G load.
2—be operable manually from the flightcrew station and the passenger compartment.
3—be armed or turned on during ground operation and all flight operations.
4—be operable from the flight deck only.

**8092.** Interior emergency lights must be armed or turned on during

1—ramp operations, taxiing, and takeoff.
2—takeoff, landing, and turbulent air operations.
3—descents, landings, and emergency descents.
4—taxiing, takeoff, and landing.

**8093.** The supplemental oxygen requirements for passengers when a flight is operated at or below FL250 is dependent upon the airplane's ability to make an emergency descent to a flight altitude of

1—10,000 feet within 4 minutes.
2—12,000 feet within 4 minutes or at a minimum rate of 2,500 feet per minute, whichever is quicker.
3—8,000 feet at a maximum rate of 3,000 feet per minute within 4 minutes.
4—14,000 feet within 4 minutes.

**8094.** A flight crewmember must be able to don and use a quick-donning oxygen mask within

1—5 seconds.
2—15 seconds.
3—20 seconds.
4—30 seconds.

**8095.** Which item of required night-flying lighting equipment may also be required to have a means of controlling the intensity of illumination?

1—Landing lights.
2—Anticollision lights.
3—Instrument lights.
4—Position lights.

**8096.** Above which cabin altitude must oxygen be provided for all persons during the entire flight?

1—All crewmembers 10,000 feet; all passengers 12,000 feet.
2—All crewmembers 12,000 feet; all passengers 15,000 feet.
3—All crewmembers 14,000 feet; all passengers 14,000 feet.
4—All crewmembers 10,000 feet.; all passengers 15,000 feet.

**8097.** The supplemental oxygen requirements for passengers when a flight is operated up to FL250 is dependent upon the airplane's ability to make an emergency descent to a flight altitude of

1—10,000 feet within 4 minutes.
2—12,000 feet within 4 minutes or at a minimum rate of 2,500 feet per minute, whichever is quicker.
3—8,000 feet at a minimum rate of 3,000 feet per minute.
4—14,000 feet within 4 minutes.

**8098.** (Refer to figure 8.) In a two-spool turbojet engine, what comparison is made between the operating temperature of position E and other locations within the engine?

1—Hotter than position D, but cooler than G.
2—Hotter than either D or G.
3—Cooler than either D or G.
4—The coolest location within the engine.

**8099.** (Refer to figure 8.) At which position given below will engine operating temperature be the lowest?

1—G.
2—F.
3—E.
4—D.

**8100.** (Refer to figure 8.) The operating temperatures listed below for a two-spool turbojet aircraft engine will be the highest at position

1—G.
2—D.
3—C.
4—B.

**8101.** If either pilot of an air carrier airplane leaves the duty station while flying at FL310, the other pilot

1—shall put on and use an oxygen mask.
2—must have a quick-donning type oxygen mask available.
3—and the flight engineer shall put on and use their oxygen masks.
4—must select emergency oxygen and put on an oxygen mask.

**8102.** A passenger aircraft is cruising at FL390 and all flight crewmember stations are provided with approved quick-donning type oxygen masks. Under which conditions must a flight crewmember put on and use an oxygen mask?

1—When the flight engineer leaves the flight engineer station, one pilot must use a mask.
2—When the captain leaves the left seat, the other pilot and flight engineer must use their masks.
3—When one pilot leaves the flight deck, the other pilot must use a mask but other crewmembers need not.
4—When any flight crewmember leaves the flight deck, all other flight crewmembers must use their masks.

**8103.** When cruising at FL350, which rule applies to the flight engineer's supplemental oxygen equipment?

1—The mask must be worn at all altitudes above FL250.
2—The oxygen regulator must be set to the 100 percent position.
3—The mask must be located within immediate reach of the flight engineer's duty station.
4—The mask must be worn if one pilot leaves the flight deck.

**8104.** How much supplemental oxygen must pressurized air carrier transport airplanes carry for each flight crewmember on flight deck duty when operating at flight altitudes above 10,000 feet?

1—A minimum of 30-minutes' supply.
2—A minimum of 2-hours' supply.
3—Sufficient for the duration of the flight above 6,000 feet cabin pressure altitude.
4—Sufficient for the duration of the flight above 8,000 feet flight altitude.

**8105.** Each air carrier flight deck crewmember on flight deck duty must be provided with a quick-donning type oxygen mask when operating at flight altitudes above

1—FL120.
2—FL180.
3—FL200.
4—FL250.

**8106.** A flight engineer on flight deck duty must use supplementary oxygen

1—when the aircraft is above FL250 regardless of the cabin altitude.
2—during night flight when the cabin altitude is above 8,000 feet.
3—after the cabin altitude has been between 10,000 and 12,000 feet for 30 minutes.
4—after 30 minutes when cabin altitude is above 10,000 feet, up to and including 12,000 feet.

**8107.** Which factors must be recorded by the approved flight recorder?

1—Airspeed, time, altitude, vertical acceleration, and heading.
2—Time, true altitude, calibrated airspeed, vertical speed, and heading.
3—Elapsed time, airspeed, altitude, vertical acceleration, and magnetic course.
4—Calibrated airspeed, time, pressure altitude, vertical acceleration or deceleration, and true course.

**8108.** Cockpit voice recorders shall be operated from the start of

1—the before-starting check to the end of the secure-cockpit check.
2—the before-takeoff check to the end of the after-landing check.
3—the takeoff roll to the end of the landing roll.
4—departure from the ramp to the next full stop at a ramp.

**8109.** The information recorded by a required cockpit voice recorder may be erased or otherwise obliterated no sooner than

1—15 minutes after recording.
2—30 minutes after recording.
3—48 hours after the end of the flight.
4—60 days after the end of the flight.

**8110.** (Refer to figure 9.) Where is the low pressure turbine located in a turbojet engine of dual-spool axial flow design?

1—B.
2—D.
3—C.
4—A.

**8111.** (Refer to figure 9.) Identify the location of the high pressure compressor as installed in a dual-spool axial flow engine?

1—A.
2—B.
3—D.
4—C.

**8112.** (Refer to figure 9.) Which combination denotes the low pressure compressor and turbine of a dual-spool axial flow turbojet engine?

1—C and D.
2—A and B.
3—A and D.
4—C and B.

**8113.** If there is a required emergency exit located in the flightcrew compartment, the door which separates the compartment from the passenger cabin must

1—not be locked during flight.
2—be locked at all times, except during emergencies while landing.
3—be locked at all times, except during any emergency declared by the pilot in command.
4—be latched open during takeoff and landing.

**8114.** Which aircraft are required to be equipped with a ground proximity warning and glide slope deviation alerting system?

1—All transport category aircraft.
2—Large turbojet-powered airplanes only.
3—Passenger-carrying aircraft only.
4—Large turbine-powered airplanes only.

**8115.** On each air carrier flight requiring a flight engineer, at least one flight crewmember, other than the flight engineer, must be qualified to provide emergency performance of the flight engineer's functions. This flight crewmember

1—must have flown 50 hours as a flight engineer within the past 6 months.
2—is not required to have a Flight Engineer Certificate.
3—must be the pilot in command to perform flight engineer functions.
4—must have a Flight Engineer Certificate.

**8116.** If the flight engineer becomes incapacitated, who may perform flight engineer duties during an IFR flight conducted under FAR Part 121?

1—A pilot crewmember but only if flight engineer certificated.
2—The pilot second in command only.
3—Any crewmember designated by the pilot in command.
4—Either pilot but only if qualified to perform flight engineer functions.

**8117.** Under which condition is a flight engineer required as a flight crewmember on a turbojet airplane certificated after January 1, 1964, and used in FAR Part 121 operations?

1—If the airplane is carrying passengers or live cargo.
2—If the airplane's takeoff weight is above 80,000 pounds.
3—If the airplane is powered by more than two engines.
4—If required by the airplane's type certificate.

**8118.** If a flight engineer is a required flight crewmember of an airplane, which of the following is true regarding flight engineer emergency evacuation duties?

1—Flight engineer emergency evacuation duties must be described in the air carrier's Flight Operations Manual.
2—A flight engineer must receive recurrent emergency evacuation training each 6 months.
3—Flight engineer emergency evacuation duties must include the opening of all emergency exits.
4—The flight engineer must demonstrate the ability to accomplish emergency evacuation functions, in an airplane or simulator, at least once each 6 months.

**8119.** What is the term for the training required for flight crewmembers who have qualified and served on a particular type airplane (e.g., Boeing 727-100) before they may serve in the same capacity on a particular variation of that airplane?

1—Programmed training.
2—Transition training.
3—Upgrade training.
4—Differences training.

**8120.** What is the term for the training required for flight crewmembers who have not qualified and served in the same capacity on another airplane of the same group (e.g., turbojet-powered)?

1—Upgrade training.
2—Transition training.
3—Primary training.
4—Initial training.

**8121.** Crewmembers who have served as a flight engineer on a particular type airplane (e.g., Lockheed L-188C), may serve as second in command upon completing which training program?

1—Differences training.
2—Recurrent training.
3—Transition training.
4—Upgrade training.

**8122.** Crewmembers who have served as flight engineer on a particular type airplane (e.g., Boeing 727-100), may serve as second in command upon completing which training program?

1—Upgrade training.
2—Recurrent training.
3—Transition training.
4—Differences training.

**8123.** (Refer to figure 10.) In this turbine engine, identify the diffuser?

1—A-4.
2—A-2.
3—B-2
4—B-4.

**8124.** (Refer to figure 10.) Item A-2 of the axial flow turbine engine depicted is known as the

1—diffuser.
2—turbine stator.
3—turbine rotor.
4—compressor stator.

**8125.** (Refer to figure 10.) In what section does initial combustion take place?

1—A-2.
2—A-4.
3—B-4.
4—B-1.

**8126.** (Refer to figure 10.) In what location within the engine is the highest air pressure?

1—A-2.
2—A-4.
3—A-3.
4—B-4.

**8127.** What is the term for the training required for flight crewmembers who have qualified and served in the same capacity on another airplane of the same group (e.g., turbojet-powered)?

1—Transition training.
2—Differences training.
3—Upgrade training.
4—Programmed training.

**8128.** The flight engineer must perform, as part of emergency training, drills utilizing the proper equipment and procedure concerning

1—operation and use of emergency exit and evacuation chutes.
2—emergency descent.
3—discharge of fire extinguishers in engine nacelles.
4—dumping of fuel down to undumpable fuel level.

**8129.** Which flight engineers may complete the entire initial flight check in an approved airplane simulator?

1—Flight engineers who possess a Commercial Pilot Certificate with instrument, category, and class ratings.
2—Flight engineers who possess a Commercial Pilot Certificate, instrument rating, and have flown more than 50 hours as a flight engineer.
3—Flight engineers who have flown more than 200 hours as a flight engineer in the aircraft over which the check is being conducted.
4—Flight engineers who have completed at least one previous flight check in an airplane similar in type.

**8130.** The air carrier must give instruction on such subjects as respiration, hypoxia, and decompression to each crewmember on pressurized airplanes operated above

1—10,000 feet.
2—12,000 feet.
3—20,000 feet.
4—25,000 feet.

**8131.** A drill which the flight engineer must perform, as a part of emergency training, is one utilizing the proper equipment and procedures concerning

1—fire extinguishing.
2—abnormal situations, such as hijacking.
3—emergency descent following rapid decompression.
4—emergency dumping of fuel.

**8132.** A flight engineer must receive recurrent training on emergency procedures at least once each

1—6 calendar months.
2—12 calendar months.
3—18 calendar months.
4—24 calendar months.

**8133.** During what preceding time period must a crewmember have completed an established training program in order to perform duties associated with the handling and carriage of dangerous articles and magnetized materials?

1—6 months.
2—12 calendar months.
3—18 calendar months.
4—24 months.

**8134.** Which requirement must be met by all flight engineers every 6 months before they can serve on an air carrier flight under FAR Part 121?

1—Upgrade training.
2—50 hours of flight time or a flight check.
3—Line check or route check.
4—Recurrent flight and ground training.

**8135.** (Refer to figure 11.) Which emergency signal, or combination of signals, is used in conjunction with a fire in the tail pipe of a turbojet aircraft?

1—D and F.
2—F only.
3—C and D.
4—B and D.

**8136.** (Refer to figure 11.) In the event of a fire in the accessory section of a turbojet aircraft, which hand signal(s) are used?

1—F.
2—C.
3—A.
4—D.

**8137.** (Refer to figure 11.) Which turbojet engine operating signal, or combination of signals, prescribes thrust reduction and engine shut down?

1—A and C.
2—D and E.
3—H and A.
4—A and E.

**8138.** In an operation that requires two pilots and one flight engineer, which flight time limitation applies?

1—350 hours during any 90 consecutive days.
2—100 hours during any 30-day period.
3—1,000 hours during any 12 calendar months.
4—300 hours during 3 calendar months.

**8139.** In the previous 6 calendar months, a person has flown 200 hours as second in command in a DC-10 airplane and 50 hours in a B-727 airplane as flight engineer. What Flight Engineer Certificate privileges may be exercised?

1—Serve as flight engineer on DC-10 airplanes only.
2—Serve as flight engineer on either DC-10 or B-727 airplanes.
3—Serve as flight engineer on B-727 airplanes only.
4—May not serve as flight engineer on any airplane until 200 flight hours as flight engineer have been accumulated.

**8140.** Having flown 40 hours as pilot in command and 40 hours as second in command in an L-382 airplane, all within the previous 6 calendar months, which flight engineer duties are you eligible to perform?

1—None, since you do not meet flight engineer qualifications for L-382 airplanes.
2—You may perform flight engineer duties on L-382 airplanes only.
3—You may serve as flight engineer on L-382 airplanes after completing a check over the airplane, conducted by a current flight engineer.
4—None, until you have accumulated 200 hours' flight time as flight engineer.

**8141.** You have served 280 hours as flight engineer on a DC-8 airplane, all within the previous 6 calendar months. What qualifications must you meet before being assigned to serve as flight engineer on a DC-10 airplane?

1—Have served at least 200 hours as flight engineer on DC-10 airplanes.
2—Have completed a flight check by the certificate holder, or have flown at least 50 hours as flight engineer in DC-10 airplanes in the previous 6 calendar months.
3—Have completed a flight check by the Administrator and have flown 50 hours as flight engineer in similar airplanes.
4—You may serve as flight engineer on a DC-10 airplane since you meet qualifications in a similar airplane.

**8142.** Duty and rest period rules for domestic air carrier operations require that a flight crewmember

1—not be assigned to any duty with the air carrier during a required rest period.
2—not be on duty aloft for more than 90 hours in any calendar month.
3—be relieved of all duty for at least 48 hours during any 7 consecutive days.
4—not be assigned to any duty for a period of at least 18 hours if the flight crewmember had been on duty aloft for 9 hours.

**8143.** What is the limitation regarding time spent by a flight engineer in deadhead air transportation returning to the home station?

1—Cannot be considered part of the engineer's required rest period.
2—Must be considered part of the engineer's duty aloft.
3—Is considered part of the engineer's total commercial flying.
4—May be considered when determining the engineer's annual flight time requirement.

**8144.** Which is a flight time limitation for a flight engineer on a domestic air carrier according to FAR Part 121?

1—30 hours in any calendar week.
2—32 hours in any 7 consecutive days.
3—100 hours in any 30 consecutive days.
4—100 hours in any calendar month.

**8145.** Flight time limitations for domestic air carrier operations require that a flight engineer be

1—limited to a maximum of 1,200 hours duty aloft in any calendar year.
2—limited to a maximum of 40 hours aloft in any 7 consecutive days.
3—relieved of all duty for at least 24 consecutive hours in any 7 consecutive days.
4—relieved of all duty for at least 48 consecutive hours in any 7 consecutive days.

**8146.** Which is a flight time limitation for a flight engineer on a flag air carrier where only one engineer is required?

1—120 hours during any 30 consecutive days.
2—300 hours during any 60 consecutive days.
3—300 hours during any 120-day period.
4—900 hours during any 12-calendar month period.

**8147.** In flag air carrier operations (overseas) where the flightcrew consists of two pilots and one flight engineer, the engineer may not be scheduled for more than

1—8 hours in any 24 consecutive hours.
2—30 hours during any 7 days.
3—300 hours in any 90 consecutive days.
4—100 hours in any 30 consecutive days.

**8148.** (Refer to figure 12.) Which instrument installed on a two-stage axial-flow turbine engine is reading the low-pressure compressor speed?

1—A.
2—B.
3—C.
4—D.

**8149.** (Refer to figure 12.) Instrument C installed on a two-stage axial-flow turbine engine is measuring the

1—ratio between exhaust gas temperature and $N_1$.
2—ratio between exhaust gas temperature and $N_2$.
3—ratio between turbine discharge total pressure and compressor inlet total pressure.
4—combined ratio between the $N_1$ and $N_2$ discharge pressures and exhaust outlet pressure.

**8150.** The flight engineer is required by regulations to be at the flight engineer station

1—only during takeoff and landing.
2—at all times unless absence is necessary in the performance of flight engineer duties, or to meet physiological needs.
3—during takeoff and landing, but may be relieved by one of the pilots during cruising flight.
4—only during takeoff and landing and during emergencies.

**8151.** During which part of the flight must the flight engineer keep the required seatbelt fastened?

1—At all times during flight.
2—During the entire time when seated at the flight engineer station.
3—Only during the time the "Fasten Seatbelt" sign is on.
4—Only during takeoff, landing, and when in turbulent air.

**8152.** Which flight crewmembers may leave their station during cruising flight to perform normal duties?

1—One pilot and the flight engineer together when required.
2—Either pilot but not the flight engineer.
3—One pilot or the flight engineer if the flight engineer station is occupied by a pilot.
4—Either pilot or the flight engineer, but only one crewmember at a time.

**8153.** The pilot in command has emergency authority to exclude people from the flight deck. Those who may be excluded from this area include

1—anyone except an FAA air carrier inspector.
2—anyone except a Federal law enforcement officer who presents proper credentials.
3—any person, in the interest of safety.
4—all persons except those specifically designated by the certificate holder as essential crewmembers.

**8154.** Each crewmember shall have available for individual use on each flight a

1—pyrotechnic signaling device.
2—quick-donning oxygen mask.
3—hand fire extinguisher suitable for combatting Class A, B, and C fires.
4—flashlight in good working order.

**8155.** Who is responsible for entry into the maintenance log of any in-flight mechanical irregularity that is noted by the flight engineer?

1—The pilot in command.
2—The flight engineer.
3—Equal responsibility between the pilot in command and the flight engineer.
4—The air carrier or its delegates.

**8156.** Which passenger announcement must be made after each takeoff?

1—The location and use of emergency exits.
2—To keep seatbelts fastened while seated.
3—How to use the passenger oxygen system in an emergency.
4—How to don and inflate a life preserver.

**8157.** In addition to the required oral briefing before each takeoff, what other information must be made available on printed cards to each passenger?

1—Rules about smoking during flight.
2—Diagrams and methods of operating the emergency exits.
3—Rules concerning the consumption of alcoholic beverages.
4—The procedure for administering first aid oxygen.

**8158.** Which rule applies when a passenger is seated in the cabin of an all-cargo aircraft?

1—The passenger must have a seat reserved on the flight deck.
2—The pilot in command may authorize the passenger to be admitted to the crew compartment.
3—The passenger must remain seated with seatbelt fastened at all times during flight.
4—Crew-type oxygen equipment must be provided for the passenger.

**8159.** The function of the minimum equipment list is to indicate required items which

1—cannot be missing from the aircraft for any air carrier flight.
2—are required to be operative when the aircraft is used on domestic passenger scheduled flights.
3—may be inoperative while permitting a ferry flight to a maintenance terminal.
4—may be inoperative for a flight beyond a terminal point.

**8160.** (Refer to figure 13.) At which point in the turbojet exhaust nozzle do the exiting gases first attain sonic velocities?

1—F.
2—A.
3—B.
4—E.

**8161.** (Refer to figure 13.) If more fuel is added after Mach 1 gas velocity is reached, what will occur at exhaust nozzle location B?

1—Afterburner operations will commence.
2—A small increase in thrust with very high internal engine temperatures.
3—The gas expanding outwards will increase mass flow, allowing the aircraft to reach supersonic regimes.
4—Exhaust gases will ball up in the tailcone and create an imbalance resulting in rich blowout.

**8162.** (Refer to figure 13.) Exhaust section E is identified as the

1—convergent section through which supersonic gases flow.
2—divergent nozzle through which supersonic gases flow.
3—subsonic portion of a convergent-divergent exhaust nozzle.
4—divergent nozzle which straightens the Mach 1 gases into subsonic flow.

**8163.** (Refer to figure 13.) Which most correctly identifies a convergent-divergent supersonic exhaust duct?

1—B only.
2—A and B.
3—C and D.
4—F only.

**8164.** The reserve fuel supply required for a domestic air carrier flight in a turbojet-powered airplane is

1—30 minutes at holding fuel consumption; 1,500 feet above the destination or alternate airport.
2—45 minutes at normal fuel consumption.
3—30 minutes at normal fuel consumption.
4—45 minutes at holding fuel consumption; 1,500 feet above the destination or alternate airport.

**8165.** The reserve fuel supply for a domestic air carrier flight in a propeller-driven aircraft shall be enough fuel for

1—30 minutes at normal cruising fuel consumption.
2—45 minutes at holding fuel consumption; 1,500 feet above the alternate airport.
3—45 minutes at normal cruising fuel consumption.
4—30 minutes at holding fuel consumption; 1,500 feet above the destination or alternate airport.

**8166.** The required fuel supply for a flag air carrier turbopropeller-powered airplane consists of fuel to fly to destination and to hold at the alternate (if specified) before landing. What type holding operation is planned in the fuel supply calculations?

1—45 minutes at traffic pattern altitude.
2—30 minutes at the most economical altitude regarding fuel consumption at holding speed.
3—45 minutes at minimum holding altitude.
4—30 minutes plus 15 percent of ETE, but not more than 90 minutes.

**8167.** Among the required items of information on the dispatch release of a domestic air carrier is the

1—name of the pilot in command.
2—weight and balance data.
3—airplane make and model.
4—minimum fuel supply.

**8168.** Which documents are required to be carried aboard each domestic air carrier flight conducted under FAR Part 121?

1—Maintenance release, weight and balance release, and flight plan.
2—Dispatch release, load manifest, and flight plan.
3—Dispatch release and weight and balance release.
4—Load manifest and flight release.

**8169.** A crewmember certificate may be issued by the FAA to flight crewmembers on U.S. registered aircraft engaged in

1—intrastate operations only.
2—supplemental air carrier operations.
3—flight crewmember training only.
4—international air commerce.

**8170.** Under what conditions must a flight engineer's crewmember certificate be surrendered to the FAA for cancellation?

1—Each year when the flight engineer takes a recurrent flight check.
2—At each renewal of the flight engineer's medical certificate.
3—Upon termination of employment with the air carrier.
4—When the flight engineer is reassigned to duty as a pilot, second in command.

**8171.** What certificate is issued to crewmembers of U.S. air carriers engaged in international air commerce?

1—An international crewmember identification card issued by No. 121.723 ICAO.
2—A U.S. Department of State identification card.
3—A crewmember certificate issued by the FAA.
4—A certificate from the embassy of each country visited.

**8172.** When a flag carrier airplane requires more than one flight engineer or flight navigator, which flight time limitation applies during any 12 calendar months?

1—900 hours.
2—1,000 hours.
3—1,100 hours.
4—1,200 hours.

**8173.** (Refer to figure 14.) If you experience total brake failure at a rollout speed of 98 knots, how much of the remaining runway would you use in 5 seconds?

1—165 feet.
2—144 feet.
3—564 feet.
4—827 feet.

**8174.** (Refer to figure 14.) You touch down at the 1,000 foot marker of a 6,050 foot runway. If your speed at touchdown is 115 knots, and braking devices are not used, how long will it take to traverse the remaining runway.

1—21 seconds.
2—31 seconds.
3—38 seconds.
4—26 seconds.

**8175.** In standard atmosphere at sea level, an engine developing full power produces a manifold pressure of 27" Hg and 2600 RPM. What approximate MP and RPM should this engine produce in a standard atmosphere at 4,000 feet MSL under full power?

1—23" Hg and 2600 RPM.
2—25" Hg and 2600 RPM.
3—27" Hg and 2200 RPM.
4—31" Hg and 3000 RPM.

**8176.** Under standard atmospheric conditions at sea level, an engine using full power produces a manifold pressure of 29" Hg and 2700 RPM. What manifold pressure should this engine be expected to produce at 3,000 feet MSL using full power under standard atmospheric conditions?

1—21" Hg and 2400 RPM.
2—26" Hg and 2700 RPM.
3—29" Hg and 2400 RPM.
4—32" Hg and 3000 RPM.

**8177.** An in-flight condition necessary for structural icing to form is

1—cumuliform clouds.
2—cirrostratus clouds.
3—stratiform clouds.
4—visible moisture.

**8178.** In which environment is aircraft structural ice most likely to have the highest accumulation rate?

1—Cumulus clouds.
2—Cirrus clouds.
3—Stratus clouds.
4—Freezing rain.

**8179.** A characteristic of the stratosphere is

1—visible moisture in the form of clouds and thunderstorms.
2—an overall decrease of temperature with an increase in altitude.
3—a relatively even base altitude of approximately 35,000 feet.
4—relatively small changes in temperature with an increase in altitude.

**8180.** The primary cause of all changes in the Earth's weather is

1—variation of solar energy received by the Earth's regions.
2—changes in air pressure over the Earth's surface.
3—changes in air moisture content.
4—movement of the air masses.

**8181.** Under which condition will pressure altitude be equal to true altitude?

1—When the OAT (outside air temperature) is colder than standard for that altitude.
2—When the atmospheric pressure is 29.92" Hg.
3—When standard atmospheric conditions exist.
4—When indicated altitude is equal to the pressure altitude.

**8182.** Under what condition is pressure altitude and density altitude the same value?

1—At standard temperature.
2—When the altimeter setting is 29.92" Hg.
3—When indicated and pressure altitudes are the same value on the altimeter.
4—At sea level, when the temperature is 0° C.

**8183.** What are the standard temperature and pressure values for sea level?

1—15° C and 29.92" Hg.
2—59° C and 1013.2 millibars.
3—59° F and 29.92" Hg millibars.
4—15° C and 1013.2" Hg.

**8184.** If the temperature/dew point spread is small and decreasing, and the temperature is 62° F, what type weather is most likely to develop?

1—Freezing precipitation.
2—Thunderstorms.
3—Fog or low clouds.
4—Rain showers.

**8185.** (Refer to figure 15.) What is the width of the danger area D for a typical transport-type jet aircraft at idle power?

1—12 feet.
2—24 feet.
3—36 feet.
4—48 feet.

**8186.** (Refer to figure 15.) The jet danger area for a large transport-type aircraft may extend as far back as position F. What is this distance?

1—500 feet.
2—400 feet.
3—300 feet.
4—200 feet.

**8187.** (Refer to figure 15.) What is the distance G which extends forward and to the side as depicted?

1—15 feet.
2—25 feet.
3—40 feet.
4—55 feet.

**8188.** (Refer to figure 15.) At idle power, what jet blast velocity may be expected at position B?

1—50 knots.
2—100 knots.
3—200 knots.
4—300 knots.

**8189.** (Refer to figure 15.) What jet blast velocity is likely at distance F, from a jet transport aircraft utilizing take off power?

1—35 knots.
2—60 knots.
3—75 knots.
4—90 knots.

**8190.** If the outside air temperature increases during a flight at constant power and at a constant indicated altitude, the true airspeed will

1—decrease and true altitude will decrease.
2—decrease and true altitude will increase.
3—increase and true altitude will decrease.
4—increase and true altitude will increase.

**8191.** Why is frost considered hazardous to flight operation?

1—The increased weight requires a greater takeoff distance.
2—Frost changes the basic aerodynamic shape of the airfoil.
3—Frost decreases control effectiveness.
4—Frost causes early airflow separation resulting in a loss of lift.

**8192.** Which conditions result in the formation of frost?

1—The freezing of dew.
2—The collecting surface's temperature is at or below freezing and small droplets of moisture fall on the collecting surface.
3—The temperature of the collecting surface is at or below the dew point of the adjacent air and the dew point is below freezing.
4—Small drops of moisture falling on the collecting surface when the surrounding air temperature is at or below freezing.

**8193.** What temperature condition is indicated if wet snow is encountered at your flight altitude?

1—The temperature is above freezing at your altitude.
2—The temperature is above freezing at higher altitudes.
3—You are flying from a warm air mass into a cold air mass.
4—You are in an "inversion" with colder air below.

**8194.** The presence of ice pellets at the surface is evidence that

1—there are thunderstorms in the area.
2—a cold front has passed.
3—there is freezing rain at a higher altitude.
4—you can climb to a higher altitude without encountering more than light icing.

**8195.** A common type of ground- or surface-based temperature inversion is that produced by

1—warm air being lifted rapidly aloft in the vicinity of mountainous terrain.
2—the movement of colder air over warm air, or the movement of warm air under cold air.
3—widespread sinking of air within a thick layer aloft resulting in heating by compression.
4—ground radiation on clear, cool nights when the wind is light.

**8196.** When a climb or descent through an inversion or wind-shear zone is being performed, you should be alert for which of the following changes in airplane performance?

1—A fast rate of climb and a slow rate of descent.
2—A sudden change in airspeed.
3—A sudden surge of thrust.
4—A sudden decrease in power.

**8197.** Which conditions are most conducive to structural icing on the airframe and propeller?

1—Temperature −10° C to 0° C and relative humidity 85 percent or more.
2—Temperature −5° C to 10° C and frozen precipitation.
3—Temperature −15° C to 0° C with visible moisture.
4—Temperature 0° C to 5° C and relative humidity 85 percent or more.

**8198.** The relative humidity of the air is 100 percent. This is an indication that

1—the temperature and dew point are equal.
2—an inversion has formed.
3—precipitation (rain or snow) is occurring.
4—the vapor pressure is zero.

**8199.** (Refer to figure 16.) In what order are the events of the energy-release cycle A through E in a turbine engine?

1—Intake, power, compression, ignition, exhaust.
2—Compression, power, ignition, turbine, exhaust.
3—Intake, compression, ignition, power, exhaust.
4—Intake, ignition, compression, power, exhaust.

**8200.** (Refer to figure 16.) What name is given to the fourth event of the turbine engine energy-release cycle?

1—Ignition.
2—Power.
3—Compression.
4—Exhaust.

**8201.** (Refer to figure 16.) The second event of the turbine engine energy-release cycle is known as the

1—power event.
2—compression event.
3—ignition event.
4—intake event.

**8202.** (Refer to figure 16.) What events of the energy-release cycle take place in sections B and D?

1—Power and ignition.
2—Intake and compression.
3—Compression and power.
4—Compression and ignition.

**8203.** Which statement is a definition of relative humidity?

1—The relative point at which the air, being cooled, becomes saturated.
2—The density of the water vapor in the air.
3—The ratio of actual water vapor in the air to the amount required for saturation.
4—The ratio of the pressure exerted by the water vapor in the air to the standard vapor pressure.

**8204.** Which is an indication of the coldest atmospheric temperature?

1—−35° C ram air temperature.
2—−35° C total air temperature.
3—−35° C static air temperature.
4—−35° C ambient air temperature.

**8205.** Which is true concerning the troposphere?

1—It is thicker over the equator than over the poles.
2—It is the dividing line between the stratosphere and the atmosphere.
3—It contains all the free oxygen of the atmosphere.
4—It extends to a uniform height at all latitudes.

**8206.** Which is true concerning the tropopause?

1—The polar tropopause is at a higher altitude than the tropical tropopause.
2—The tropopause is the dividing line between the atmosphere and the stratosphere.
3—The tropopause is higher in the summer than in the winter.
4—Above the tropopause, the oxygen content of the air drops to approximately 2 percent.

**8207.** During a climb, the tropopause can be identified as the altitude where the

1—air density starts to increase as altitude increases.
2—atmospheric pressure becomes zero.
3—jetstream winds are encountered.
4—temperature lapse rate makes an abrupt change.

**8208.** An inversion can be identified by the

1—pressure lapse rate.
2—tropopause location.
3—temperature lapse rate.
4—jetstream location.

**8209.** The average altitude for one-half atmosphere pressure level (500 millibar) is

1—10,000 feet.
2—13,000 feet.
3—18,000 feet.
4—25,000 feet.

**8210.** What is the relationship between altitudes when the altimeter setting is higher than standard while flying at 15,000 feet indicated altitude?

1—Indicated altitude is higher than pressure altitude.
2—Indicated altitude is lower than true altitude.
3—Indicated altitude is lower than pressure altitude.
4—Indicated altitude is higher than true altitude.

**8211.** To obtain pressure altitude during flight, adjust the altimeter to

1—29.92" Hg and read pressure altitude directly from the altimeter.
2—the current altimeter setting and read pressure altitude directly from the altimeter.
3—the current altimeter setting and adjust the indicated altitude with the correction factor from a pressure altitude table.
4—29.92" Hg and correct the indicated altitude for temperature.

**8212.** Without the use of supplemental oxygen, crewmembers and passengers would suffer from hypoxia in high altitude unpressurized flight. This problem occurs because as altitude is increased,

1—nitrogen in the atmosphere and in the bloodstream expands.
2—the percentage of oxygen in the atmosphere is decreased.
3—the percentage of nitrogen in the atmosphere is increased.
4—oxygen partial pressure is decreased.

**8213.** What effect will an increase in altitude have upon the available ESHP (equivalent shaft horsepower) of a gas turbine-propeller engine?

1—Lower air density and engine mass flow will cause a decrease in power.
2—Higher air density and engine mass flow will cause an increase in power.
3—Power will remain the same as altitude does not affect turbine propeller engines.
4—Power will remain the same due to ram recovery.

**8214.** (Refer to figure 17.) The modern turbine engine consists of four basic sections. What is the name of section C?

1—Exhaust.
2—Turbines.
3—Combustors.
4—Compressors.

**8215.** (Refer to figure 17.) In what section of the modern turbojet engine is air compressed?

1—A.
2—C.
3—B.
4—D.

**8216.** (Refer to figure 17.) Where is the fuel/air combination ignited in turbine engine?

1—D.
2—A.
3—C.
4—B.

**8217.** To obtain optimum range conditions in a turbojet airplane, cruising flight should be planned

1—at any altitude within the confines of the troposphere.
2—at or above the tropopause.
3—with a power setting that results in .82 Mach.
4—for the altitude at which .82 Mach is first obtainable.

**8218.** What effect does high ambient temperature have upon the ESHP (equivalent shaft horsepower) of a gas turbine-propeller engine?

1—A noticeable loss of output power due to a decrease in air density.
2—An increase in power output due to better vaporization of fuels.
3—No noticeable change in output power, but turbine temperatures may be higher.
4—No noticeable change in output power, but compressor temperatures will be higher.

**8219.** As outside air pressure decreases, thrust output will

1—increase due to greater efficiency of jet aircraft in thin air.
2—remain the same as the greater speed from reduced drag will allow greater inlet velocities.
3—remain the same because compression of inlet air will compensate for any decrease in air pressure.
4—decrease due to lower air density.

**8220.** What effect does high specific humidity have upon the maximum power output of modern airplane engines?

1—Humidity has no effect on either turbine or reciprocating engines.
2—Both turbine and reciprocating engines experience a significant loss of power.
3—Reciprocating engines may experience as much as a 12 percent loss of brake horsepower.
4—Turbine engines suffer as much as a 20 percent loss of power.

**8221.** At what altitude will the typical turbojet airplane achieve maximum specific endurance conditions?

1—Any altitude allowing a speed of .82 Mach.
2—Altitudes anywhere in the tropopause.
3—Altitudes at, or near the tropopause.
4—Any altitude that allows .82 Mach to be achieved with reserve power.

**8222.** With regard to airplane performance, why is it important to know the flight level of the tropopause?

1—Turboprop airplanes operate most efficiently at, or above, the tropopause.
2—Turbojet airplanes cruise most efficiently at, or above, the tropopause.
3—The tropopause level is where the most severe turbulence is found.
4—Flight above the tropopause is not recommended because the highly rarified atmosphere severely reduces engine performance and cruise efficiency.

**8223.** What effect, if any, does high ambient temperature have upon the thrust output of turbine engines?

1—Thrust may be reduced as much as 20 percent due to a decrease in air density.
2—Thrust will remain the same due to compression of the air entering the engine.
3—Operating temperatures will be higher, but thrust will remain the same.
4—Thrust will increase due to higher turbine temperatures allowing greater heat extraction.

**8224.** An airplane is flying at a constant flight level and at a power schedule which produces maximum air miles per pound of fuel. In this event, as the weight of the airplane reduces, engine power setting or fuel flow is

1—held constant to simplify fuel consumption computations.
2—reduced to maintain the best constant airspeed.
3—reduced to maintain the best L/D ratio flight conditions.
4—increased to allow flight at maximum efficient airspeed relative to tailplane drag.

**8225.** The trimming devices on a particular airplane include trailing edge tabs on the rudder and ailerons. If the airplane is trimmed to a more nose-right and right wing-up position, the right aileron trim tab will move

1—up and the rudder tab will move to the left.
2—down and the rudder tab will move to the left.
3—up and the rudder tab will move to the right.
4—down and the rudder tab will move to the right.

**8226.** The trimming devices on a particular airplane include trailing edge tabs on the rudder and a movable horizontal stabilizer. If the airplane is trimmed to a more nosedown and nose left position, the stabilizer leading edge will move

1—down and the rudder tab will move to the right.
2—down and the rudder tab will move to the left.
3—up and the rudder tab will move to the right.
4—up and the rudder tab will move to the left.

**8227.** (Refer to figure 18.) Oil entering the cylinder of a counterweight propeller is

1—forcing the blades to a lower angle.
2—holding the blades in a feather position.
3—holding the blades in the start position.
4—forcing the blades to a lower angle.

**8228.** (Refer to figure 18.) Sudden loss of engine oil pressure would cause the blades of this counterweight propeller to

1—move to a lower angle because of centrifugal force on the counterweights.
2—move to the highest angle from centrifugal force on the counterweights.
3—remain in the position they were in when the oil pressure was lost.
4—move to a lower angle because of the oil pressure in the dome.

**8229.** The angle of attack which produces the highest L/D ratio

1—remains constant as weight is changed, but decreases as altitude is increased.
2—increases as weight or altitude is increased.
3—remains constant as altitude is changed, but decreases as weight is reduced.
4—remains constant regardless of weight or altitude.

**8230.** Which factors are used to define the angle of attack of an airfoil?

1—Chord line of the airfoil and the horizon.
2—Bottom surface of the wing and the flightpath.
3—Mean chord of the airfoil and the relative wind.
4—Relative wind and chord line.

**8231.** During a coordinated turn in level flight at a constant airspeed, centrifugal force is counterbalanced by

1—the weight of the airplane.
2—the coordinated use of rudder control.
3—the increased speed of the high wing and decreased speed of the low wing.
4—a portion of the lift of the wing.

**8232.** Which factor has the effect of reducing takeoff decision speed (IAS)?

1—High density altitude.
2—High gross weight.
3—Dry runway with uphill slope.
4—Slush on runway.

**8233.** Which factor causes the decreased pressure on the upper surface of the wing?

1—The curvature of the upper surface causes the air to burble and break away from the upper surface, leaving an area of lower pressure.
2—The curvature of the upper surface of the wing tends to deflect the air away from the upper surface, thereby decreasing the pressure on the upper surface.
3—Air flowing over the upper surface of the wing travels faster than the air passing beneath the wing.
4—Air flowing over the upper surface of the wing travels at a slower speed than the air beneath the surface of the wing due to the drag caused by the curvature of the upper surface.

**8234.** The true airspeed at which an airplane stalls varies with

1—load factor, weight, and density altitude.
2—load factor and angle of attack.
3—density altitude, weight, and angle of attack.
4—groundspeed, load factor, and density altitude.

**8235.** The angle of attack at which an airplane stalls

1—decreases with an increase in engine power.
2—remains constant regardless of gross weight.
3—increases with an increase in engine power.
4—varies with gross weight and density altitude.

**8236.** Wingtip vortices which trail behind airplanes in flight are caused by the

1—pressure differential existing between the upper and lower surfaces of the wings.
2—axial flow or jetwash from turbine-driven airplanes.
3—propwash, or jetwash, depending on the type and speed of the airplane.
4—slipstream or propwash of propeller-driven airplanes.

**8237.** Compared to a no-wind condition, what effect would a 20-knot headwind component have on takeoff performance?

1—Actual groundspeed at rotation will be greater than $V_R$.
2—The airplane will reach critical engine failure indicated airspeed at a lower groundspeed.
3—Critical engine failure speed and actual groundspeed will be the same as in a zero-wind condition.
4—The effect of wind on initial acceleration will result in a longer takeoff roll.

**8238.** While flying in a steady wind of 25 knots, the airplane is turned from a direct headwind to a direct tailwind. The indicated airspeed would

1—remain the same, but the groundspeed would increase 50 knots.
2—increase 25 knots, and the groundspeed would increase 25 knots.
3—decrease 25 knots, and the groundspeed would increase 25 knots.
4—increase 50 knots, and the groundspeed would increase 25 knots.

**8239.** (Refer to figure 19.) The blades of this counterweight propeller are

1—moving to a lower angle from reduced flow of engine oil.
2—moving to a higher angle by centrifugal force on the counterweights.
3—remaining in equilibrium.
4—being forced to a higher angle through engine oil flow.

**8240.** (Refer to figure 19.) The blade movement of the depicted counterweight propeller is best described as

1—decreasing in angle.
2—feathered.
3—increasing in angle.
4—fluctuating high to low.

**8241.** What is a disadvantage of a sweptwing design compared to a straight-wing design?

1—The wing root stalls prior to the tip section, resulting in unequal wing loading.
2—The forward shift of center of pressure contributes to a severe pitchdown moment.
3—There is an extremely powerful tendency for the wing to stall tip first, compromising aileron control.
4—It produces lower local lift coefficients toward the wingtip.

**8242.** Shock-induced separation of airflow occurring symmetrically near the wing root of a sweptwing may result in

1—a high-speed stall and sudden pitchup due to the center of pressure moving forward on the wing.
2—sudden and immediate separation of the wing root aft of the main spar.
3—severe porpoising due to attempt to recover control while under reverse command.
4—a severe diving moment, or "tuck under," due to center of pressure moving aft on the wing and a decrease of downwash on the horizontal tail.

**8243.** When the wingtips of a sweptwing transport airplane are shock-stalled first, this will result in the center of pressure moving

1—inward and forward, causing pitchup.
2—inward and aft, causing pitchdown.
3—outward and forward, causing pitchdown.
4—outward and aft, causing pitchup.

**8244.** On sweptwing transport-type airplanes, gusts may cause the airplane to roll in one direction while yawing to the other. This is known as

1—porpoising.
2—wingovers.
3—barrel rolling.
4—Dutch roll.

**8245.** Aircraft equipped with both high-speed and low-speed ailerons will use the outboard ailerons only during

1—low-speed operations.
2—high-speed operations.
3—transonic flight.
4—low altitude operations.

**8246.** The phenomenon exhibited by sweptwing airplanes, in gusty conditions, whereby one wing rises and the nose yaws in the opposite direction is known as

1—barrel rolling.
2—Dutch rolling.
3—aileron rolling.
4—adverse yaw.

**8247.** High-speed transport airplanes of tapered sweptwing design, while in turbulent conditions, exhibit a tendency to roll one direction while the nose yaws opposite. To eliminate this, these aircraft are equipped with a

1—ventral fin.
2—rudder lock.
3—yaw dampener.
4—rudder trim.

**8248.** The speed at which the airflow over the wing first reaches the speed of sound is known as the

1—Reynolds number.
2—transonic index.
3—critical Mach number.
4—region of reverse command.

**8249.** Transonic flight regimes usually occur within Mach

1—0.50 to 0.75.
2—0.75 to 1.20.
3—1.20 to 2.50.
4—2.50 and above.

**8250.** Mach numbers from 0.75 to 1.20 describe the regime of

1—subsonic flight.
2—supersonic flight.
3—transonic flight.
4—hypersonic flight.

**8251.** (Refer to figure 20.) What propeller condition is depicted?

1—Feather.
2—Overspeed.
3—Underspeed.
4—Onspeed.

**8252.** A sweepback design wing has a principal advantage over a straight-wing design in that

1—the critical Mach number will decrease significantly.
2—the critical Mach number will increase significantly.
3—sweepback will increase changes in the magnitude of force coefficients due to compressibility.
4—sweepback will accelerate the onset of compressibility effects.

**8253.** The highest flight speed possible without supersonic flow over the wing is termed the

1—Mach tuck speed.
2—critical Mach number.
3—transonic index.
4—initial buffet speed.

**8254.** A free stream Mach number which produces first evidence of local sonic flow is known as the

1—transonic Mach number.
2—supersonic Mach number.
3—detached shock wave Mach number.
4—critical Mach number.

**8255.** Subsonic flight regimes usually occur at Mach numbers

1—below 0.75.
2—from .075 to 1.20.
3—from 1.20 to 2.50.
4—above 2.50.

**8256.** Which has the effect of increasing load factor?

1—Vertical gusts.
2—Increased airplane weight.
3—Increased air density.
4—Rearward CG location.

**8257.** For an airplane with a given gross weight and constant cruise speed, what is the relationship between fuel flow, temperature, and altitude? Fuel flow is higher when

1—both temperature and altitude are increased.
2—temperature is increased and altitude is decreased.
3—both temperature and altitude are decreased.
4—temperature is decreased and altitude is increased.

**8258.** When monitoring the airplane's power boost control system, a flight engineer knows that a ratio number of 14 means that

1—control deflection distance is multiplied by a factor of 14.
2—each 1 inch of cockpit control movement results in 14 inches of flight control movement.
3—the maximum cockpit control force required to fully deflect any control is 14 pounds.
4—each 1 pound of cockpit control force results in 14 pounds of applied control force.

**8259.** What is the primary source of directional stability for an airplane?

1—Vertical tail.
2—Horizontal tail.
3—Center-of-gravity position.
4—Center-of-pressure position.

**8260.** If an airplane changes angle of attack, how is the horizontal tail affected?

1—The horizontal tail will experience a smaller change in angle of attack.
2—Both the airplane and horizontal tail will experience the same angle of attack.
3—The horizontal tail will experience a greater angle of attack.
4—Horizontal tails do not experience angles of attack, therefore, are not affected.

**8261.** When will power applications cause the greatest change in airplane trim and stability?

1—Operation at low power settings and high airspeed.
2—When on a power approach at low airspeeds.
3—Operation at high gross weight and low airspeed.
4—When power is applied simultaneous with a configuration change.

**8262.** (Refer to figure 21.) The propeller condition depicted is

1—overspeed.
2—onspeed.
3—feather.
4—underspeed.

**8263.** When is an airplane described as being in equilibrium?

1—When the airplane is disturbed from its flightpath, it will return without control use.
2—There are no accelerations, and the airplane continues in steady flight.
3—If the airplane is disturbed from its path, it will continue in the direction of the disturbance.
4—When the airplane has neither the tendency to continue or return from disturbance displacement.

**8264.** When is an airplane considered to be in trim?

1—The airplane maintains constant pitch attitude without control pressure.
2—There is no tendency to roll about any axis.
3—Roll, pitch, and yaw moments are equal to zero.
4—Lift, gravity, thrust, and drag are equal.

**8265.** What is the absolute ceiling of an airplane?

1—The altitude that produces a rate of climb of 100 feet per minute.
2—The altitude which produces zero rate of climb.
3—The maximum operating altitude as specified by the manufacturer.
4—The maximum altitude at which the engines will no longer develop full power.

**8266.** What consideration should be included in determining the optimum altitude for best cruise conditions?

1—Select the highest altitude at which maximum continuous power provides optimum aerodynamic conditions.
2—The maximum altitude providing a forecasted tailwind component.
3—Choose the highest altitude available, but not above the tropopause.
4—Use the maximum altitude with temperatures at, or below, ISA standard temperature for that altitude.

**8267.** Which factor is most significant when determining the optimum cruise altitude available?

1—Fuel requirement to climb to altitude.
2—Winds aloft and temperature forecast.
3—Gross weight of the airplane at the beginning of the cruise.
4—The ability to make a long, gradual descent from cruise altitude to make up time lost in the climbout.

**8268.** An airplane is climbing at Mach .78 during an en route climb. In this case, the true airspeed would

1—remain the same throughout the climb.
2—increase as pressure decreases.
3—increase with altitude.
4—decrease as the temperature decreases.

**8269.** An airplane is descending at a constant Mach .6. What would occur regarding the true airspeed?

1—Remain constant.
2—Decrease as pressure increases.
3—Decrease as altitude decreases.
4—Increase as temperature increases.

**8270.** How is true airspeed determined?

1—Correcting EAS for density altitude error.
2—Correcting CAS for instrument and position error.
3—Correcting IAS for compressibility.
4—Correcting IAS for density altitude error.

**8271.** Takeoff speed limits $V_1$, $V_R$, and $V_2$, contained in performance charts and tables of the airplane flight manual, are to be observed on the captain's airspeed indicator. These speeds are classified as

1—equivalent airspeeds.
2—indicated airspeeds.
3—true airspeeds.
4—corrected airspeeds.

**8272.** Which factor has the effect of increasing $V_1$ speed?

1—Downhill runway slope.
2—High takeoff gross weight.
3—Dry, cold air.
4—Slush or standing water on the runway.

**8273.** (Refer to figure 22.) What propeller condition is depicted?

1—Entering overspeed.
2—Beginning underspeed.
3—Entering reverse.
4—Being feathered.

**8274.** What is a characteristic of the constant Mach cruise control procedure?

1—Thrust is reduced as aircraft weight decreases.
2—True airspeed decreases as OAT increases.
3—EPR is increased as OAT increases.
4—EPR is increased as aircraft weight decreases.

**8275.** Variations in $V_{REF}$ for a particular airplane are primarily a function of

1—landing weight.
2—takeoff weight, wind component, and runway length.
3—number of engines operating and flap configuration.
4—gross weight, pressure altitude, and ambient temperature.

**8276.** Variations in 1.3 $V_{SO}$ for a particular airplane are primarily a function of

1—takeoff weight, wind component, and runway length.
2—landing weight.
3—number of engines operating and flap configuration.
4—gross weight, pressure altitude, and ambient temperature.

**8277.** The landing speed, in terms of TAS, for a particular weight and configuration of the aircraft will

1—increase as relative humidity is decreased.
2—increase as altitude is increased.
3—remain constant regardless of altitude.
4—decrease as atmospheric pressure is decreased.

**8278.** The ratio of nautical miles per hour to fuel flow in pounds per hour identifies which item relating to airplane performance?

1—Specific fuel consumption.
2—Specific fuel flow.
3—Specific range.
4—Specific endurance.

**8279.** Which flight condition of a large jet airplane creates the most severe flight hazard by generating wingtip vortices of the greatest strength?

1—Heavy, slow, gear and flaps up.
2—Heavy, slow, gear and flaps down.
3—Heavy, fast, gear and flaps up.
4—Heavy, fast, gear and flaps down.

**8280.** Critical Mach number means the

1—speed at which there is supersonic airflow over all parts of the aircraft.
2—speed at which the aircraft starts to tuck or buffet.
3—highest flight speed without supersonic flow over any part of the aircraft.
4—highest speed at which the aircraft is certificated for operation.

**8281.** Mach number is commonly defined as the

1—ratio of equivalent airspeed to the speed of sound.
2—speed of sound under conditions of standard pressure and temperature.
3—calibrated airspeed corrected for position and instrument error.
4—ratio of true airspeed to the speed of sound.

**8282.** In comparing a straight wing and a sweptback wing of the same wing area and wing loading, the sweptback wing has the advantage of

1—lower stalling speed.
2—greater mean aerodynamic chord.
3—increased longitudinal stability.
4—higher critical Mach number.

**8283.** The use of a slot in the leading edge of the wing enables the airplane to land at a slower speed because it

1—changes the camber of the wing.
2—increases the ground effect.
3—decelerates the upper surface boundary layer air.
4—delays the stall to a higher angle of attack.

**8284.** (Refer to figures 23 and 24.) What is the takeoff power setting under operating conditions No. 1.

1—54.7" manifold pressure.
2—59.5" manifold pressure.
3—204 BMEP.
4—234 BMEP.

**8285.** (Refer to figures 23 and 24.) Compute takeoff power setting as indicated under operating conditions No. 2.

1—54.5" manifold pressure.
2—60.9" manifold pressure.
3—190 BMEP.
4—200 BMEP.

**8286.** (Refer to figures 23 and 24.) Using operating conditions No. 3, compute the appropriate takeoff power setting?

1—55.6" manifold pressure.
2—59.9" manifold pressure.
3—206 BMEP.
4—236 BMEP.

**8287.** Which relationship is true at constant airspeed in level flight?

1—Lift equals total drag.
2—Lift exceeds airplane weight.
3—Drag equals total engine power output.
4—Thrust equals drag.

**8288.** During flight with zero angle of attack, the pressure along the upper surface of the wing would be

1—less than atmospheric pressure.
2—equal to atmospheric pressure.
3—greater than atmospheric pressure.
4—greater than the pressure below the wing.

**8289.** As it applies to airfoils, which statement is in agreement with Bernoulli's Principle?

1—The speed of a fluid increases at points where the pressure of the fluid increases.
2—The pressure of a fluid decreases at points where the speed of the fluid increases.
3—The pressure of a fluid increases at points where the speed of the fluid increases.
4—The pressure of a fluid decreases at points where the speed of the fluid decreases.

**8290.** An airplane wing is designed to produce lift resulting from relatively

1—positive air pressure below and above the wing's surface.
2—negative air pressure below the wing's surface and positive air pressure above the wing's surface.
3—positive air pressure below the wing's surface and negative air pressure above the wing's surface.
4—negative air pressure below and above the wing's surface.

**8291.** Which statement describes the relationship of the forces acting on an airplane in a constant-power and constant-airspeed descent?

1—Thrust is equal to drag; weight is greater than lift.
2—Thrust is equal to drag; lift is equal to weight.
3—Thrust is greater than drag; weight is greater than lift.
4—Thrust is greater than drag; lift is equal to weight.

**8292.** Changes in the center of pressure of a wing affect the airplane's

1—aerodynamic balance and controllability.
2—center-of-gravity location.
3—lifting capacity.
4—L/D ratio.

**8293.** Lift produced by an airfoil is the net force developed perpendicular to the

1—Earth's surface.
2—relative wind.
3—chord.
4—longitudinal axis of the aircraft.

**8294.** When considering the forces acting upon an airplane in straight-and-level flight at constant airspeed, which statement is correct?

1—Drag always acts rearward parallel to relative wind and is less than thrust.
2—Thrust always acts forward parallel to the relative wind and is greater than drag.
3—Lift always acts perpendicular to the longitudinal axis of the wing and is greater than weight.
4—Weight always acts vertically toward the center of the Earth.

**8295.** The point on an airfoil through which lift acts is the

1—midpoint of the chord.
2—center of pressure.
3—center of rotation.
4—CG.

**8296.** (Refer to figure 25.) During wind-swell-ditch heading situations, which airplane is depicted in the most desirable position?

1—A.
2—B.
3—C.
4—D.

**8297.** (Refer to figure 25.) Which airplane depicted is in the least desirable position for wind-swell-ditching operations?

1—A.
2—B.
3—C.
4—D.

**8298.** (Refer to figure 25.) When ditching to the face and back of a swell movement, which airplane position is most desirable?

1—A only.
2—B only.
3—Either A or B.
4—Neither A or B.

**8299.** (Refer to figure 25.) In the event of ditching to the face and back of a swell, which airplane position would be least effective?

1—A only.
2—B only.
3—Either A or B.
4—Neither A or B.

**8300.** When the angle of attack of an asymmetrical airfoil is increased, the center of pressure will

1—remain unaffected.
2—move forward.
3—move aft.
4—move erratically.

**8301.** Forward elevator control pressure is needed whenever power is added, because the

1—download on the tail surface increases, therefore, increasing the pitch-up tendency.
2—lift on the tail surface is decreased by the decreased downwash.
3—nose of the airplane is pulled upward due to the added thrust.
4—nose of the airplane raises due to the increased angle of attack and additional lift.

**8302.** In steady-state flight the sum of the opposing forces acting on an airplane is equal to

1—the total weight of the airplane.
2—the total weight of the airplane plus the total drag.
3—zero.
4—the thrust plus total lift.

**8303.** The use of a slot in the leading edge of the wing enables the airplane to land at a slower speed because it

1—changes the camber of the wing.
2—increases the ground effect.
3—decelerates the upper surface boundary layer air.
4—delays the stall to a higher angle of attack.

**8304.** In comparing a straight wing and a sweptback wing of the same wing area and wing loading, the sweptback wing has the advantage of

1—lower stalling speed.
2—greater mean aerodynamic chord.
3—increased longitudinal stability.
4—higher critical Mach number.

**8305.** Which adverse stability characteristic is caused by sweepback?

1—Increase of Dutch roll tendency.
2—Increase of longitudinal static stability.
3—Increase of Mach tuck tendency.
4—Increase of critical Mach number.

**8306.** A rectangular wing, as compared to other wing planforms, has a tendency to stall first at the

1—wing root providing adequate stall warning.
2—wingtip providing adequate stall warning.
3—wing root providing inadequate stall warning.
4—wingtip providing inadequate stall warning.

**8307.** The purpose of airplane wing dihedral angle is to

1—increase lateral stability.
2—increase longitudinal stability.
3—increase lift coefficient of the wing.
4—decrease drag coefficient of the wing.

**8308.** Aspect ratio of a wing is defined as the ratio of the

1—wingspan to the wing root.
2—square of the chord to the wingspan.
3—wingspan to the mean aerodynamic chord.
4—wing spar to the main compression rib.

**8309.** At a constant velocity in airflow, a high aspect ratio wing will have (in comparison with a low aspect ratio wing)

1—decreased drag, especially at a high angle of attack.
2—increased drag, especially at a high angle of attack.
3—increased drag, especially at a low angle of attack.
4—decreased wing performance when in a climbing attitude.

**8310.** (Refer to figure 26.) What is the CG in percent of MAC?

Basic Operating Weight.....105,000 lb
Basic Operating Index.....92,827.0
(Moment/1,000)
MAC - 860.2 - 1040.9
Passenger Load:
Fwd compt.....Full
Aft compt.....105
Fuel load:
Tanks 1 and 3 (each).....Full
Tank 2.....24,000 lb
Cargo Load:
Fwd hold.....3,500 lb
Aft hold.....1,200 lb

1—25.0 percent MAC.
2—26.0 percent MAC.
3—27.0 percent MAC.
4—28.0 percent MAC.

**8311.** (Refer to figure 26.) Determine the CG in inches aft of LEMAC.

Basic Operating Weight.....105,000 lb
Basic Operating Index.....98,827.0
(Moment/1,000)
MAC - 860.2 - 1040.9
Passenger Load:
Fwd compt.....Full
Aft compt.....83
Fuel Load:
Tanks 1 and 3 (each).....12,000 lb
Tank 2.....Full
Cargo Load:
Fwd hold.....3,500 lb
Aft hold.....2,000 lb

1—43.8 inches.
2—45.7 inches.
3—46.3 inches.
4—47.4 inches.

**8312.** (Refer to figure 26.) What is the CG in inches aft of datum?

Basic Operating Weight.....105,000 lb
Basic Operating Index.....92,827.0
(Moment/1,000)
MAC - 860.2 - 1040.9
Passenger Load:
Fwd compt.....19
Aft compt.....66
Cargo Load:
Fwd hold.....950 lb
Aft hold.....775 lb
Fuel Load:
Tanks 1 and 3 (each).....10,500 lb
Tank 2.....24,500 lb

1—902.6 inches.
2—905.3 inches.
3—906.5 inches.
4—910.4 inches.

**8313.** Rotation about the vertical axis of an airplane is known as

1—yawing, and is controlled by the use of rudder.
2—rolling, and is controlled by the use of ailerons.
3—turning, and is controlled by the use of ailerons.
4—pitching, and is controlled by the use of elevators.

**8314.** The three axes of an airplane intersect at the

1—CG.
2—center of pressure.
3—midpoint of the datum line.
4—midpoint of the mean chord.

**8315.** The angle between the chord line of an airfoil and the relative wind is known as the angle of

1—attack.
2—lift.
3—incidence.
4—longitudinal dihedral.

**8316.** The angle between the chord line of the wing and the longitudinal axis of the airplane is known as the angle of

1—attack.
2—relative wind.
3—incidence.
4—dihedral.

**8317.** What changes in airplane control must be made to maintain altitude while the airspeed is being decreased?

1—Increase the angle of attack to compensate for the decreasing lift.
2—Increase the angle of attack to produce more lift than drag.
3—Decrease the angle of attack to compensate for the increasing drag.
4—Maintain a constant angle of attack until the desired airspeed is reached, then increase the angle of attack.

**8318.** The angle of attack of a wing directly controls the

1—amount of airflow above and below the wing.
2—point at which the CG is located.
3—distribution of positive and negative pressure acting on the wing.
4—angle of incidence of the wing.

**8319.** If the airspeed of an airplane is doubled while the angle of attack remains the same, the drag will

1—remain the same.
2—double.
3—decrease as airspeed increases.
4—be four times greater.

**8320.** What effect will a decreasing air density have on lift and drag?

1—Lift will increase and drag will decrease.
2—Lift and drag will increase.
3—Lift and drag will decrease.
4—Lift will decrease and drag will increase.

**8321.** Which statement is true regarding the forces acting on an aircraft in a steady-rate climb? The sum of all

1—forward forces is less than the sum of all rearward forces.
2—forward forces is greater than the sum of all rearward forces.
3—upward forces is greater than the sum of all downward forces.
4—upward forces is equal to the sum of all downward forces.

**8322.** No person may act as crewmember of a civil aircraft while using any drug that affects their faculties in any way contrary to safety, or have consumed alcoholic beverages within the preceding

1—8 hours with the exception of nonprescription items such as antihistamines and cold tablets.
2—8 hours to include nonprescription items such as some antihistamines and cold tablets.
3—12 hours with the exception of nonprescription drugs.
4—12 hours to include nonprescription drugs.

**8323.** (Refer to figure 27.) For the listed conditions, what is the approximate duration of the passenger oxygen system?

Cabin altitude.....15,000 ft
Passengers.....120
Bottle pressure.....1,500 PSIG

1—23 minutes.
2—25 minutes.
3—26 minutes.
4—28 minutes.

**8324.** (Refer to figure 27.) What is the approximate duration of the passenger oxygen system for the conditions shown?

Cabin altitude.....20,000 ft
Passengers.....75
Bottle pressure.....1,200 PSIG

1—15 minutes.
2—17 minutes.
3—19 minutes.
4—23 minutes.

**8325.** The primary purpose of high lift devices is to increase the

1—L/D max.
2—lift at slow speeds.
3—drag and reduce airspeed.
4—approach and landing speeds.

**8326.** Weight X Arm divided by the Reduction Factor is the formula used to determine

1—total moments.
2—CG from LEMAC.
3—index units.
4—CG station of the main gear.

**8327.** Which of the following weight factors determine ramp or taxi weight?

1—Zero fuel weight plus payload, fuel, and oil.
2—Payload plus operating weight.
3—Takeoff weight minus taxi fuel.
4—Zero fuel weight plus total fuel load.

**8328.** The payload of a transport aircraft consists of

1—passengers, baggage, and cargo only.
2—passengers, cargo, and fuel only.
3—crew, passengers, baggage, cargo, and fuel only.
4—all weights in excess of zero fuel weight.

**8329.** The term mean aerodynamic chord may be defined as the

1—distance from the leading edge to the trailing edge of the wing, measured at the wing root.
2—total lift of an airfoil divided by its mean chord.
3—ratio of the average wing chord to its aerodynamic center of pressure.
4—chord of an imaginary airfoil which has the same aerodynamic characteristics as the actual airfoil.

**8330.** The CG of an airplane is normally located in the fuselage at a point expressed in

1—percentage of MAC aft of the leading edge of the wing.
2—inches from the leading edge of the wing.
3—inches from the forward CG limit.
4—percent of mean aerodynamic chord aft of LEMAC.

**8331.** The basic operating weight of a transport airplane is the empty weight plus

1—required crew and standard operating items.
2—fuel and oil.
3—required crew.
4—fixed ballast, hydraulic fluid, undrainable fuel, and undrainable oil.

**8332.** What is a definition of zero fuel weight?

1—Basic operating weight plus maximum capacity of passengers and cargo.
2—Empty weight plus passengers and cargo.
3—Takeoff weight minus fuel to destination and alternate.
4—Basic operating weight plus payload.

**8333.** The maximum allowable aircraft weight, above which all of the load must consist of usable or dumpable fuel, is called

1—maximum payload weight.
2—maximum zero fuel weight.
3—maximum landing weight.
4—basic operating weight.

**8334.** The authorized maximum takeoff weight of a transport airplane, when less than the maximum certificated weight, is a factor which

1—varies with runway length, airport elevation, and ambient temperature.
2—may not be more than 105 percent of the maximum landing weight.
3—is the sum total of the maximum zero fuel weight and the maximum allowable fuel load.
4—may be increased by headwind components and higher than normal temperature.

**8335.** (Refer to figure 28.) During an in-flight engine start procedure, what action should be taken if an engine is windmilling at 24 percent $N_1$ and 32 percent $N_2$, when operating at FL320 and a speed of 260 knots?

1—The engine may be started under the existing conditions.
2—The engine may be started after increasing $N_1$ RPM with the starter.
3—The engine should not be started.
4—The engine may be started after increasing $N_2$ RPM with the starter or bleed air from an operating engine.

**8336.** (Refer to figure 28.) What action should be taken if an engine is windmilling at 20 percent $N_1$ and 26 percent $N_2$, when operating at FL350 with a speed of 240 knots?

1—The engine may be started under the existing conditions.
2—The engine may be started if the airspeed is reduced.
3—The engine should not be started because the $N_2$ RPM is out of tolerance.
4—The engine should not be started because both the $N_1$ and $N_2$ RPM's are out of tolerance.

**8337.** The CG of an airplane is computed along the

1—lateral axis.
2—vertical axis.
3—longitudinal axis.
4—horizontal axis.

**8338.** If the nosewheel of an airplane moves forward upon gear retraction, would this forward movement affect the CG location of that airplane?

1—Yes; the CG would move aft.
2—Yes, but the CG movement would be unpredictable.
3—No; the CG would not move.
4—Yes; the CG would move forward.

**8339.** If the landing gear of an airplane moves rearward when retracting, would this affect the CG?

1—No; the CG location would remain the same.
2—Yes, but the CG movement would be unpredictable.
3—Yes; the CG would move aft.
4—Yes; the CG would move forward.

**8340.** The CG of an aircraft can be determined by

1—multiplying total weight by total moments.
2—dividing total arms by total moments.
3—dividing total moments by total weight.
4—multiplying total arms by total weight.

**8341.** If the landing gear on an airplane moves forward during retraction, the

1—total moments will decrease.
2—total moments will remain the same.
3—total moments will increase.
4—CG will remain the same.

**8342.** Based on this information, the CG would be located how far aft of datum?

Weight "X" — 1,330 pounds at 117 inches aft of datum
Weight "Y" — 1,110 pounds at 110 inches aft of datum
Weight "Z" — 750 pounds at 210 inches aft of datum

1—126.43 inches.
2—136.43 inches.
3—142.43 inches.
4—152.43 inches.

**8343.** Could 100 pounds of baggage be shifted from station 130.0 to station 30.0 without exceeding the forward CG limit?

Total weight.....2,800 lb CG
CG location..... Station 120.0
Fwd CG limit..... Station 117.0

1—No, the new CG would be located at station 116.42.
2—No, the new CG would be located at station 116.89.
3—Yes, the new CG would be located at station 117.89.
4—Yes, the new CG would remain at station 120.0.

**8344.** Based on this information, the CG would be located how far aft of datum?

Weight "A" — 1,200 pounds at 5 inches aft of datum
Weight "B" — 2,200 pounds at 17 inches aft of datum
Weight "C" — 875 pounds at 195 inches aft of datum

1—1500.6 inches.
2—500.6 inches.
3—50.6 inches.
4—5.06 inches.

**8345.** Based on this information, where would the CG be located?

Weight "D" — 601 pounds at 45 inches aft of datum
Weight "E" — 700 pounds at 145 inches aft of datum
Weight "F" — 125 pounds at 185 inches aft of datum

1—100.06 inches aft of datum.
2—106.36 inches aft of datum.
3—116.26 inches aft of datum.
4—136.06 inches aft of datum.

**8346.** How much weight could be added at station 1600 without exceeding the aft CG limit?

Aircraft weight.....83,000 lb
CG location..... Station 900
Aft CG limit.....Station 905

1—139 pounds.
2—166 pounds.
3—597 pounds.
4—697 pounds.

**8347.** How much weight could be added at station 1200 without exceeding the aft CG limit?

Aircraft weight.....95,000 lb
CG location..... Station 890
Aft CG limit..... Station 900

1—2669.8 pounds.
2—2966.6 pounds.
3—3066.8 pounds.
4—3166.6 pounds.

**8348.** What is the maximum weight that could be added at station 1500 without exceeding the aft CG limit?

Aircraft weight.....150,000 lb
CG location..... Station 980
Aft CG limit.....Station 1000

1—6,000 pounds.
2—5,769 pounds.
3—600 pounds.
4—576 pounds.

**8349.** What is the location of the CG if 900 pounds are removed from station 1400?

Aircraft weight.....162,300 lb
CG location..... Station 790

1—659.70 inches.
2—700.59 inches.
3—705.90 inches.
4—879.41 inches.

**8350.** (Refer to figure 29.) While operating at FL270 and a speed of 280 knots, what action should be taken if an engine is windmilling at 21 percent $N_1$ and 28 percent $N_2$?

1—The engine should not be started.
2—The engine may be started, but only after decreasing the altitude.
3—The engine should not be re-started at any altitude or airspeed.
4—The engine may be started at the existing airspeed.

**8351.** (Refer to figure 29.) If an engine is windmilling at 21 percent $N_1$ and 25 percent $N_2$, while operating at an altitude at FL280 and a speed of 270 knots, what action should be taken?

1—The engine may be started at the existing airspeed.
2—The engine may be started only after a reduction of airspeed.
3—The engine should not be started.
4—Engine start may be initiated after descent to a lower altitude.

**8352.** What is the location of the CG if 1,460 pounds are removed from station 1500?

Aircraft weight.....171,520 lb
CG location..... Station 820

1—814.17 inches.
2—817.14 inches.
3—822.25 inches.
4—825.83 inches.

**8353.** What is the location of the CG if 600 pounds are removed from station 700?

Aircraft weight.....184,200 lb
CG location..... Station 850

1—849.50 inches.
2—850.49 inches.
3—851.00 inches.
4—860.49 inches.

**8354.** Could 1,000 pounds of baggage be shifted from station 30.0 to station 120.0 without exceeding the aft CG limit?

Total weight..... 147,500 lb
CG location..... Station 115.8
Aft CG limit.....Station 118.0

1—Yes, the CG would be located at station 115.19.
2—Yes, the new CG would be located at station 116.41.
3—No, the new CG would be located at station 118.41.
4—No, the new CG would be located at station 119.05.

**8355.** How much cargo must be shifted from the aft cargo compartment at station 150.0 to the forward cargo compartment at station 30.0 to move the CG to the aft CG limit?

Total weight..... 175,000 lb
CG location..... Station 805
Aft CG limit.....Station 795

1—145.83 pounds.
2—1458.3 pounds.
3—14583.0 pounds.
4—Shift cannot be completed at station 30.0.

**8356.** An airplane with a gross weight of 185,500 pounds has the CG located at 980 inches aft of datum. The arm of the forward hold is 440 inches; the aft cargo hold is 1,150 inches. If 600 pounds of cargo are shifted from the aft hold to the forward hold, how far will the new CG shift forward?

1—1.27 inches.
2—2.29 inches.
3—3.00 inches.
4—3.56 inches.

**8357.** An airplane's gross weight is 170,500 pounds and the CG is at 980 inches aft of datum. The arm of the forward cargo hold is 430 inches, and the arm of the aft cargo hold is 1,130 inches. If 800 pounds of cargo are shifted from the forward hold to the aft hold, how far will the new CG shift aft?

1—4.01 inches.
2—3.28 inches.
3—2.38 inches.
4—1.87 inches.

**8358.** How far will the CG shift, if 1,000 pounds of cargo are moved from the aft compartment to the forward compartment?

Aircraft gross weight..... 155,000 lb
CG prior to shift..... 1,000" aft of datum
Arm of forward compartment..... 670" aft of datum
Arm of aft compartment..... 1,166" aft of datum

1—3.2 inches.
2—2.5 inches.
3—2.0 inches.
4—1.5 inches.

**8359.** What should be the new CG location if 800 pounds of cargo are moved from the forward cargo hold to the aft cargo hold?

Airplane gross weight..... 150,000 lb
CG prior to shift..... 998.0" aft of datum
Arm of forward hold..... 667.0" aft of datum
Arm of aft hold..... 1,160" aft of datum

1—1,000.6 inches.
2—996.0 inches.
3—994.8 inches.
4—994.0 inches.

**8360.** What is the total air carrier standard weight of 47 winter passengers, 3 crewmembers, and 2 female flight attendants?

1—8,840 pounds.
2—8,525 pounds.
3—8,370 pounds.
4—8,320 pounds.

**8361.** What is the combined air carrier standard weight for a summertime flight consisting of 36 passengers, 3 flight crewmembers, 1 male flight attendant, and 1 female flight attendant?

1—6,550 pounds.
2—6,560 pounds.
3—6,930 pounds.
4—6,970 pounds.

**8362.** (Refer to figure 30.) Determine the go-around EPR's for these conditions?

Pressure altitude..... 4,000 ft
OAT..... -5°C.
A/C bleeds..... Normal
Anti-ice..... Engine and Wing ON, 2 Bleeds

1—Engines 1 and 3, 2.11; Engine 2, 2.11.
2—Engines 1 and 3, 2.12; Engine 2, 2.20.
3—Engines 1 and 3, 2.21; Engine 2, 2.23.
4—Engines 1 and 3, 2.14; Engine 2, 2.22.

**8363.** (Refer to figure 30.) For the depicted conditions, determine the required go-around EPR's?

Pressure altitude..... 2,000 ft
TAT..... 10°C.
A/C bleeds..... Normal
Anti-ice..... Engine ON, Wing OFF

1—Engines 1 and 3, 2.13; Engine 2, 2.13.
2—Engines 1 and 3, 2.13; Engine 2, 2.16.
3—Engines 1 and 3, 2.17; Engine 2, 2.16.
4—Engines 1 and 3, 2.04; Engine 2, 2.11.

**8364.** (Refer to figure 30.) Determine the go-around EPR's for these conditions?

Pressure altitude..... 2,000 ft
OAT..... 18°C.
A/C bleeds
  Engines 1 and 2..... ON
  Engine 3..... OFF
Anti-ice..... OFF

1—Engine 1, 2.16; Engine 2, 2.12; Engine 3, 2.16.
2—Engine 1, 2.12; Engine 2, 2.11; Engine 3, 2.16.
3—Engine 1, 2.08; Engine 2, 2.15; Engine 3, 2.12.
4—Engine 1, 2.11; Engine 2, 2.08; Engine 3, 2.07.

**8365.** What procedure is used to clear excessive fuel from a reciprocating engine equipped with a float-type carburetor?

1—Crank the engine with the starter, or by hand, with the mixture control in cutoff, ignition switch off, and the throttle fully open, until the fuel charge has been cleared.
2—Crank the engine with the starter, or by hand, with the mixture control in cutoff, ignition switch off, and the throttle closed until the fuel charge has been cleared.
3—Turn off the fuel and ignition. Discontinue the start attempt for approximately one hour.
4—Crank the engine with the starter or by hand, with the mixture control in cutoff, ignition switch on, and the throttle fully open, until excess fuel has cleared, or until the engine starts.

**8366.** If fuel flows steadily from the internal supercharger drain valve during an engine start, which is the probable cause?

1—Excessive use of boost pumps.
2—The fuel relief valve is stuck.
3—Improper setting of the mixture control.
4—Leaky manifold inside the engine case.

**8367.** While starting a large, reciprocating, radial engine, you experience an induction fire. How should this fire be extinguished?

1—Direct carbon dioxide into the air intake of the engine.
2—Direct carbon dioxide into the exhaust system.
3—Close the fuel shut off valve and let the fire burn out.
4—Close the throttle and place the mixture in the idle-cutoff position.

**8368.** After starting a large reciprocating engine, which of the following indicators should be checked first?

1—Oil pressure.
2—Manifold pressure.
3—Tachometer.
4—Cylinder head temperature.

**8369.** You determine your fuel load of 100/130 aviation gasoline has been contaminated with Jet-A fuel. What action should be taken?

1—Determine the brand of Jet fuel, then contact the local manufacturer for guidance and dilution ratios.
2—Adjust mixture to compensate for the octane change.
3—Determine the amount of the jet fuel put in the tanks, and if under 25 percent of the total fuel volume, no action is needed.
4—Have fuel tanks and lines drained, then refilled with properly rated fuel.

**8370.** Which of the following most correctly describes the total piston displacement of a reciprocating engine?

1—The distance a piston travels compared to its diameter.
2—The relationship of horsepower output per cubic inch of cylinder volume.
3—The volume displaced by the sum total of all pistons during one revolution of the crankshaft.
4—The volume displaced by one piston during one revolution of the crankshaft.

**8371.** For what purpose is ventilating air used in a combustion heater?

1—Provides combustion air for ground blower operation.
2—Transports heat to locations where it is needed.
3—Keeps the overhead thermal switch cool.
4—Provides an oxygen source to support the flame.

**8372.** What is the purpose of a dump valve in a pressurized airplane?

1—Relieve all positive pressure from the cabin.
2—Relieve the negative pressure differential.
3—Unload the pressurization compressors.
4—Reduce pressure in excess of maximum differential.

**8373.** How is cabin pressurization usually controlled?

1—By a valve that stops the pressurization pump when a pressure equivalent to the maximum safe cabin altitude has been reached.
2—Use of a pressure-sensitive switch that causes the pressurization pump to turn on or off as required.
3—Utilization of a cabin outflow valve that dumps all pressure in excess of a preset amount.
4—By a pressure-sensitive valve that controls the output volume of the pressurization pump.

**8374.** During pressurized flight at cruise altitude, you select auxiliary (ambient) ventilation. What condition will result?

1—Cabin pressure will increase.
2—The cabin compressor will overspeed.
3—Cabin altitude will increase.
4—Air conditioning efficiency will increase.

**8375.** Setting the cabin pressure control will affect which of the following?

1—Cabin outflow valve opening.
2—Cabin supercharger compression ratio.
3—Pneumatic system pressure.
4—Turbocompressor speed.

**8376.** After takeoff, you notice the cabin pressure rate of climb is excessive. You should adjust the cabin pressure controls to cause the

1—cabin outflow valve to close more slowly.
2—cabin compressor speed to increase.
3—cabin outflow valve to close faster.
4—cabin compressor speed to decrease.

**8377.** (Refer to figures 31 and 32.) Determine the maximum takeoff power settings.

Pressure altitude..... 2,000 ft
OAT..... +40°F.
A/C bleed..... OFF
Engine A/I..... ON
Engine 3 EPR gauge..... Inoperative

1—Engine 1, 2.17; Engine 2, 2.18; Engine 3, 97.2.
2—Engine 1, 2.03; Engine 2, 1.97; Engine 3, 97.9.
3—Engine 1, 2.21; Engine 2, 2.15; Engine 3, 97.8.
4—Engine 1, 2.22; Engine 2, 2.15: Engine 3, 97.2.

**8378.** (Refer to figures 31 and 32.) Compute the maximum takeoff power settings.

Pressure altitude..... -1,000 ft
OAT..... +59°F.
A/C bleed..... OFF
Engine A/I..... ON
Engine 3 EPR gauge..... Inoperative

1—Engine 1, 2.08; Engine 2, 2.06; Engine 3, 94.3.
2—Engine 1, 2.08; Engine 2, 2.03; Engine 3, 96.4.
3—Engine 1, 2.04; Engine 2, 2.06; Engine 3, 95.2.
4—Engine 1, 2.12; Engine 2, 2.13; Engine 3, 97.4.

**8379.** Should the cabin air compressor become disengaged, what prevents the cabin from depressurizing?

1—Firewall shutoff valve.
2—Supercharger disconnect mechanism.
3—Cabin pressure outflow valve.
4—Delivery air duct check valve.

**8380.** While cruising at 18,000 feet you experience failure of the automatic cabin pressure controls. Using manual controls, the cabin pressure is stabilized at 3,000 feet. If the airplane climbs 500 feet and the manual control is not changed, how will this affect the cabin altitude?

1—Cabin altitude will remain at 3,000 feet.
2—The cabin altitude will climb to 18,500 feet.
3—Cabin altitude will descend to 2,500 feet.
4—The cabin altitude will climb to 3,500 feet.

**8381.** A reciprocating engine powered airplane fuselage is subjected to five major stresses. The stress of pressurization would be classified as

1—tension stress.
2—compression stress.
3—torsion stress
4—shear stress.

**8382.** What controls the amount of oxygen delivered to a mask when using a continuous-flow system?

1—Calibrated orifice.
2—Line valve.
3—Pressure reducing valve.
4—Pilot's regulator.

**8383.** The flight deck of your reciprocating engine powered airplane is equipped with a diluter-demand oxygen regulator. When does the system deliver oxygen to the user?

1—When the diluter control is set at normal.
2—Anytime the user demands 100 percent oxygen.
3—Each time the user takes a breath.
4—Anytime oxygen cylinder pressure exceeds 75 PSI.

**8384.** For what purpose are high altitude airplane cabins pressurized?

1—Prevent excessive build up of carbon dioxide in the body.
2—Reduce the possibility of hyperventilation.
3—Create a proper environment for prevention of hypoxia.
4—Prevent incidents of carbon monoxide poisoning.

**8385.** What does a red radial line on the face of an engine instrument indicate?

1—Normal operating range.
2—Caution range.
3—Temporary operating range under special conditions.
4—Maximum or minimum safe operating limit.

**8386.** Why do large airplanes, powered with reciprocating engines utilize a fuel crossfeed system?

1—Allow dumping of excess fuel by pumping overboard.
2—Reduce the number of total fuel lines required.
3—To maintain a balanced fuel condition.
4—Reduce fueling time.

**8387.** Which is a function of the fuel crossfeed system as found on large multiengine airplanes?

1—Allow the feeding of any engine from a specified tank.
2—Permit the removal of any residual fuels.
3—Assist in defueling when necessary to balance the CG.
4—Provide automatic refueling of a tank to a specified level.

**8388.** Prior to accepting fuel by the single point pressure method, what important precaution should be observed?

1—Determine the truck pump pressure is compatible with the airplane fuel system.
2—Truck pump pressure must be set to the minimum allowed for minimum filter pressures.
3—Fuel delivery hoses must be connected prior to grounding.
4—The airplane's electrical system should be activated in order to obtain fuel quantity readings.

**8389.** (Refer to figure 33.) Under the following conditions, what is the approximate duration of a passenger oxygen system?

Cabin altitude.....20,000 ft
Passengers.....165
Bottle pressure.....1,500 PSIG

1—19 minutes.
2—21 minutes.
3—27 minutes.
4—30 minutes.

**8390.** (Refer to figure 33.) Under the depicted conditions, what is the approximate duration of a passenger oxygen system?

Cabin altitude.....25,000 ft
Passengers.....110
Bottle pressure.....1,300 PSIG

1—18 minutes.
2—20 minutes.
3—22 minutes.
4—24 minutes.

**8391.** When moving the mixture control to the idle-cutoff position on a large reciprocating engine, what should be observed on the tachometer?

1—An immediate drop in RPM.
2—A slight increase in RPM before the engine starts to die.
3—Slight decrease in RPM, followed by an immediate drop to zero.
4—The RPM will remain the same until the cutoff mode is reached, then a rapid drop to zero.

**8392.** What is the function of a fuel totalizer on a large reciprocating engine airplane?

1—Measures the amount of fuel used by each engine.
2—Shows the amount of fuel in any given tank.
3—Indicates the total rate of consumption of all operating engines.
4—Indicates the amount of fuel in all the fuel tanks.

**8393.** Which would provide the first positive indication that a change-over from one fuel tank to another is needed?

1—Fuel pressure warning.
2—Fuel pressure gauge.
3—Fuel flowmeter.
4—Fuel quantity indicator.

**8394.** On airplanes powered by large reciprocating engines, what is the primary purpose for operating fuel boost pumps?

1—To provide a positive flow of fuel to the engine at all flight attitudes.
2—For intermittent use during takeoff and landing only.
3—To enable the engineer to transfer fuel between tanks.
4—Ensure all available fuel is used from the tanks.

**8395.** When an ammeter is installed in the battery charging system, what does it indicate?

1—Amperage available for appliance use.
2—Total amperage being used by the airplane.
3—Rate of current being used to charge the batteries.
4—The electrical integrity of the battery system.

**8396.** How are fuses installed in reciprocating engine-powered airplane protective systems rated?

1—Volts.
2—Ohms.
3—Amperes.
4—Microfarads.

**8397.** Large airplanes are equipped with takeoff warning systems to alert the crew that a flight control is not properly set prior to takeoff. What activates the warning system?

1—Operating the landing gear switch.
2—Release of compression to the ground proximity switch (squat switch).
3—Throttles up to the takeoff position.
4—Operating the flap extension switch.

**8398.** Which of the following may be used to eliminate carburetor ice?

1—Alcohol spray and heated induction air.
2—Alcohol spray and heated induction duct.
3—Ethylene glycol spray and heated induction air.
4—Ethylene glycol spray and electrically heated air intake.

**8399.** In the event of a reciprocating engine fire, what occurs when the emergency shutoff valves are closed?

1—Fuel flow to the engine will be blocked.
2—The fire-warning system will be deactivated.
3—Fire extinguishers will automatically be discharged.
4—The fire-detection system will be deactivated.

**8400.** Which of the following will decrease the volumetric efficiency of a reciprocating engine?

1—Higher than specified fuel octane rating.
2—High oil temperature.
3—Low carburetor air inlet temperature.
4—High cylinder head temperature.

**8401.** (Refer to figure 34.) What action should be taken if an engine is windmilling at 19.5 percent $N_1$ and 25.5 percent $N_2$, when operating at FL350 and a speed of 240 knots?

1—The engine may be started if airspeed is reduced.
2—The engine should not be started because the $N_2$ RPM is out of tolerance.
3—The engine should not be started because the $N_1$ and $N_2$ RPM are out of tolerance.
4—The engine may be started under the existing conditions.

**8402.** What type of horsepower is developed in the cylinders of a reciprocating engine?

1—Shaft horsepower.
2—Indicated horsepower.
3—Brake horsepower.
4—Thrust horsepower.

**8403.** In the order of occurrence, what are the five events of a four-stroke cycle reciprocating engine?

1—Intake, ignition, compression, power, and exhaust.
2—Intake, power, compression, ignition, and exhaust.
3—Intake, compression, ignition, power, and exhaust.
4—Intake, ignition, power, compression, and exhaust.

**8404.** On which stroke, or strokes are both valves open on a four-stroke cycle reciprocating engine?

1—Exhaust.
2—Intake.
3—Power and intake.
4—Exhaust and intake.

**8405.** Regarding the operation of a reciprocating four-stroke cycle engine, which statement is correct?

1—The intake valve closes on the compression stroke.
2—The exhaust valve opens on the exhaust stroke.
3—The intake valve opens on the intake stroke.
4—The exhaust valve closes on the exhaust stroke.

**8406.** In a conventional reciprocating engine, when is the fuel/air mixture ignited?

1—When the piston has reached top dead center of the intake stroke.
2—Just as the piston begins the power stroke.
3—Shortly before the piston reaches the top of the compression stroke.
4—When the piston reaches top dead center of the compression stroke.

**8407.** Why does engine smoothness of operation improve with an increase in the total number of cylinders?

1—The power impulses are spaced closer together.
2—The engine is heavier, therefore less torsional movement with each compression stroke.
3—The number of cylinders has nothing to do with the smoothness of operation.
4—The engine has larger counterbalance weights.

**8408.** Compression ratio is best described as the ratio between the

1—piston travel on the compression stroke and the intake stroke.
2—combustion chamber pressure on the combustion stroke and the exhaust stroke.
3—cylinder volume with the piston at bottom dead center and at top dead center.
4—fuel/air combination in the combustion chamber.

**8409.** What is the purpose of a power check (run up) on a large reciprocating engine?

1—Determine amount of magneto drop.
2—Check the operation of the propeller governor.
3—Determine overall satisfactory performance.
4—Establish warm up and power output capability.

**8410.** Before attempting to start a radial engine that has been shut down for more than 30 minutes, what should be done?

1—Place the fuel selector in the OFF position.
2—Pull the propeller through by hand in the opposite direction of rotation to purge the cylinders of any trapped liquids.
3—Prior to energizing the starter, place the ignition switch in the ON position with throttle open.
4—By hand, turn the propeller three or four revolutions in the normal direction to check for liquid lock.

**8411.** Engine operating flexibility is best described as the ability of the engine to

1—deliver maximum horsepower at a specific altitude.
2—meet exacting requirements of efficiency with a low weight to horsepower ratio.
3—run smoothly and give the desired performance at all speeds.
4—expand and contract with temperature to maintain design operating tolerances.

**8412.** (Refer to figure 35.) Determine the maximum takeoff EPR.

Pressure altitude..... 2,000 ft
OAT.....59°F.
Turbocompressors.....Nos. 2 and 3, ON
Turbocompressor.....No. 4, OFF
Engine A/I.....ON

1—Eng.1, 1.88; Eng.2, 1.91; Eng.3, 1.91; Eng.4, 1.88.
2—Eng.1, 1.85; Eng.2, 1.83; Eng.3, 1.83; Eng.4, 1.85.
3—Eng.1, 1.83, Eng.2, 1.83; Eng.3, 1.83; Eng.4, 1.85.
4—Eng.1, 1.91, Eng.2, 1.88; Eng.3, 1.88; Eng.4, 1.91.

**8413.** (Refer to figure 35.) Compute the maximum takeoff EPR.

Pressure altitude..... Sea Level
OAT.....-10°C.
Turbocompressors.....Nos. 2 and 3, ON
Turbocompressor.....No. 4, OFF
Engine A/I.....ON

1—Eng.1, 1.83; Eng.2, 1.83; Eng.3, 1.83; Eng.4, 1.85.
2—Eng.l, 1.85; Eng.2, 1.83; Eng.3, 1.83; Eng.4, 1.85.
3—Eng.1, 2.01; Eng.2, 1.98; Eng.3, 1.98; Eng.4, 2.01.
4—Eng.1, 1.98; Eng.2, 1.98; Eng.3, 1.98; Eng.4, 2.01.

**8414.** High density altitude has a decided effect on engine carburetion. This results in a loss of engine power output by

1—excessive enrichment of the fuel/air mixture.
2—excessive leaning of the fuel/air mixture.
3—a decrease in fuel volatility.
4—a decrease in fuel vapor pressure.

**8415.** What affect will an increase in relative humidity have on engine induction air?

1—A decrease in standard engine power at a constant RPM and manifold pressure setting.
2—Increased power output due to increased volumetric efficiency.
3—A reduction in fuel flow requirements at high-power settings due to reduced detonation tendencies.
4—A leaning effect on those engines using nonautomatic carburetors.

**8416.** How does detonation differ from pre-ignition?

1—Pre-ignition occurs in only a few cylinders at one time.
2—Detonation cannot be detected as easily as pre-ignition.
3—Pre-ignition will cause loss of power, but will not damage an engine.
4—Detonation usually occurs in only a few cylinders at one time.

**8417.** What will cause an unsupercharged reciprocating engine, operating at maximum RPM and manifold pressure, to lose power as altitude is increased?

1—The engine will lose power due to the reduced volume of air drawn into the cylinders at altitude.
2—Power output will remain unchanged until you have reached design service ceiling.
3—Power indicators will read less, but true power output will increase slightly due to the reduced exhaust back pressure augmenting thrust.
4—The engine will lose power due to the reduced density of the air drawn into the cylinders.

**8418.** Which of the following would most likely cause a reciprocating engine to backfire through the induction system when operated at low RPM?

1—Idle speed set to low.
2—Carburetor heat on at idle.
3—Clogged air inlet.
4—Excessive lean mixture setting.

**8419.** What operational sequence should be used to reduce the power output of a reciprocating engine equipped with a constant speed propeller?

1—Reduce RPM, then manifold pressure.
2—Reduce RPM, then adjust propeller control as needed.
3—Reduce manifold pressure, then retard the throttle to obtain the desired RPM.
4—Reduce the manifold pressure, then RPM.

**8420.** Which is true concerning fuel/air ratios?

1—The mixture ratio that provides the best power is richer than the mixture ratio which provides the maximum economy.
2—A lean mixture is faster burning than a normal mixture.
3—A rich mixture is faster burning than a normal mixture.
4—The mixture ratio that gives maximum economy may also be designated as best power mixture.

**8421.** Which condition is most likely to cause backfiring through the carburetor?

1—Excessive manifold pressure.
2—Excessive lean mixture.
3—Highly atomized fuel.
4—Partially blocked air inlet.

**8422.** Which condition may cause a reciprocating engine to detonate?

1—Use of fuels with high combustion rate characteristics.
2—Decreased density of the charge delivered to the cylinders.
3—Excessive rich mixture.
4—Fouled spark plugs.

**8423.** To reduce power output on an engine equipped with a constant speed propeller that is operating near maximum BMEP, you should

1—reduce manifold pressure with the throttle before RPM is reduced with the propeller control.
2—reduce manifold pressure with the propeller control before RPM is reduced with the throttle.
3—reduce RPM with the throttle before manifold pressure is reduced with the propeller control.
4—adjust RPM with throttle to reduce cylinder head temperature, then reduce manifold pressure with the propeller control.

**8424.** Engine critical altitude is the highest altitude at which an engine will maintain

1—peak horsepower at maximum available manifold pressure.
2—maximum brake horsepower at maximum continuous rotational speed.
3—maximum continuous horsepower at maximum continuous rotational speed.
4—maximum cruise horsepower.

**8425.** (Refer to figure 36.) What action should be taken if an engine is windmilling at 19.5 percent $N_1$ and 25.5 percent $N_2$ while operating at FL350 at a speed of 240 knots?

1—Do not start the engine because $N_1$ and $N_2$ RPM's are out of tolerance for a restart.
2—The engine may be started if airspeed is reduced.
3—Do not start the engine because $N_2$ RPM is out of tolerance.
4—The engine may be started under the existing conditions.

**8426.** On a large reciprocating engine, which is the most accurate indicator of fuel consumption?

1—Fuel flowmeter.
2—BMEP indicator.
3—Fuel pressure gauge.
4—Fuel totalizer.

**8427.** What purpose does a manifold pressure gauge serve?

1—Maintains constant pressure in the intake manifold.
2—Indicates differential pressure between the intake manifold and atmospheric pressure.
3—Measures the ratio of pressure altitude to that of the fuel/air mixture.
4—Indicates absolute pressure in the intake manifold.

**8428.** While operating a highly supercharged engine with a power setting near maximum BMEP, the line between the manifold pressure gauge and the engine induction system breaks. What will the gauge indicate?

1—Lower than ambient pressure at cruising RPM, and higher than ambient pressure at idling RPM.
2—Lower than ambient pressure at high altitude, and higher than ambient pressure at low altitude.
3—Ambient pressure at all engine and airplane speeds.
4—Zero, due to the separation from the pressure source.

**8429.** What is the purpose of an exhaust gas analyzer?

1—Indicates brake specific fuel consumption.
2—Indicates the fuel/air ratio being burned in the cylinders.
3—Shows the temperature of the exhaust gases in the exhaust manifold.
4—Identifies the grade of fuel being consumed.

**8430.** What is affected by a change in manifold pressure?

1—Piston displacement.
2—Compression ratio.
3—Crankshaft speed.
4—Mean effective cylinder pressure.

**8431.** Which is not used to detect fires in reciprocating engine nacelles?

1—Smoke detectors.
2—Overheat detectors.
3—Rate of temperature rise detectors.
4—Flame detectors.

**8432.** In the event of a carburetor, or intake fire, which would be the most satisfactory extinguishing agent?

1—Carbon dioxide.
2—Dry chemical.
3—Methyl bromide.
4—Carbon tetrachloride (Halon 104).

**8433.** On reciprocation engines equipped with CO-2 fire extinguisher systems, what events take place with the activation of the fire "T" Handle?

1—Closes all firewall shutoff valves, disconnects generator and discharges fire bottles.
2—Actuates the release lever of the CO-2 cylinder valve, distributing the fire extinguishing agent through perforated tubes encircling the engine.
3—Silences the fire bell, closes the fuel shutoff valve to the engine, closes the hydraulic shutoff valve, disconnects the generator from the electrical system, and arms the fire extinguishing system.
4—Closes the hydraulic shutoff valve, disconnects the generator from the electrical system, extinguishes the fire warning light and discharges the fire extinguishing agent into the engine.

**8434.** Which is the most satisfactory extinguishing agent for use on an electrical fire?

1—Water.
2—Carbon tetrachloride (Halon 104).
3—Carbon dioxide.
4—Methyl bromide.

**8435.** Which fire detection system will detect a fire when an element is inoperative, but will not test when the circuit is energized?

1—Thermocouple system.
2—Thermal system.
3—Kidde system.
4—Lindberg system.

**8436.** (Refer to figure 37.) Determine normal takeoff EPR for the depicted conditions.

Pressure altitude..... 2,000 ft
OAT.....47°F.
Assumed temperature..... 95°F.
Cabin compressors..... Two OFF
Rain removal..... OFF

1—1.80.
2—1.81.
3—1.90.
4—1.91.

**8437.** (Refer to figure 37.) What is the normal takeoff EPR for these conditions?

Pressure altitude..... 5,000 ft
OAT.....40°F.
Assumed temperature..... 80°F.
Cabin compressors..... Two ON
Rain removal..... ON

1—1.85.
2—1.86.
3—1.92.
4—1.93.

**8438.** If the airplane is equipped with a battery rated to deliver 45 amperes for 2.5 hours, what is the ampere-hour rating?

1—112.5 ampere-hour.
2—90.0 ampere-hour.
3—18.0 ampere-hour.
4—2.5 ampere-hour.

**8439.** Under continuous use, how long will a 140 ampere-hour battery last delivering 15 amperes?

1—15 hours.
2—12.6 hours.
3—9.33 hours.
4—3.66 hours.

**8440.** Which airplane electrical function does not contain a fuse?

1—Generator circuit.
2—Air-conditioning.
3—Exterior lighting.
4—Starter circuit.

**8441.** The use of cold weather oils for operation at extremely high temperatures will result in what indications?

1—Oil pressure will be higher than normal.
2—Oil pressure gauges will fluctuate excessively.
3—Oil temperature and oil pressure will be higher than normal.
4—Oil pressure will be lower than normal.

**8442.** Which will generally require an oil separator?

1—Engine-driven oil pressure pump.
2—Engine-driven vacuum pump.
3—In-line oil cooler.
4—Oil strainer.

**8443.** Measuring the time in seconds for 60 cubic centimeters of oil to flow through an exactly calibrated orifice at a specified temperature is a measurement of oil's

1—flash point.
2—specific gravity.
3—viscosity.
4—pour point.

**8444.** Oil viscosity index is based upon

1—ability to maintain film strength.
2—resistance to flow at standard temperature compared to paraffin based oil at the same temperature.
3—rate of change in viscosity relative to temperature.
4—rate of flow through a specified orifice.

**8445.** Why do large reciprocating engines utilize high viscosity oils?

1—Thin oils are unable to maintain adequate film strength at altitude (reduced atmospheric pressure).
2—High engine rotational speeds break down thin oils.
3—Large part clearances and high operating temperatures require high viscosity.
4—High viscosity oils have a lower oxidation rate at elevated temperatures.

**8446.** In addition to cushioning shock, reducing friction, and cleaning the engine, what other purpose does the engine oil serve?

1—Cooling the engine.
2—Preventing fatigue of metal parts.
3—Heating fuel to prevent carburetor icing.
4—Preventing internal crankcase pressure build up.

**8447.** Which has the greatest effect on oil viscosity?

1—Temperature.
2—Flash point.
3—Pressure.
4—Volatility.

**8448.** (Refer to figure 38.) Determine the takeoff speeds for these conditions.

Gross weight.....250,000 lb
Pressure altitude.....428 ft
OAT.....96°F.
Flaps.....25°
Tailwind.....5 knots
Airport.....SEA R/W34

1—$V_1$, 118; $V_R$, 132; $V_2$, 145.
2—$V_1$, 117; $V_R$, 133; $V_2$, 144.
3—$V_1$, 116; $V_R$, 131; $V_2$, 143.
4—$V_1$, 120; $V_R$, 154; $V_2$, 165.

**8449.** (Refer to figure 38.) Compute the correct takeoff speed for the following conditions.

Gross weight.....310,000 lb
Pressure altitude.....428 ft
OAT.....96°F.
Flaps.....15°
Headwind.....15 knots
Airport.....SEA R/W 16

1—$V_1$, 139; $V_R$, 157; $V_2$, 166.
2—$V_1$, 145; $V_R$, 157; $V_2$, 165.
3—$V_1$, 143; $V_R$, 155; $V_2$, 166.
4—$V_1$, 141; $V_R$, 156; $V_2$, 165.

**8450.** In a large reciprocating engine, what is the purpose of an oil cooler bypass valve?

1—Direct cold oil into the oil supply tank.
2—Direct cold oil into the intake side of the pressure pump.
3—Direct hot oil into the oil supply tank.
4—Direct cold oil directly to the filter.

**8451.** In a large reciprocating engine, the lubricating oil extracts heat from which major source?

1—Rods and bearings.
2—Cylinder walls.
3—Oil cooler.
4—Valve sections.

**8452.** Which has the least effect on oil consumption?

1—Lubricant characteristics.
2—Engine RPM.
3—Engine temperature.
4—Mechanical efficiency.

**8453.** Large reciprocating engines may utilize an oil dilution system to aid cold weather starting. How is the oil thinned?

1—Kerosene added to the oil just prior to shut down.
2—Gasoline added to the oil just prior to start up.
3—Kerosene added to the oil just prior to start up.
4—Gasoline added to the oil just prior to shut down.

**8454.** If the full-flow oil filter on an aircraft engine should become clogged, what would happen?

1—Oil pressure build up will cause the filter to collapse and starve the engine for oil.
2—Oil will be bypassed to the oil sump, where the blockage will be removed.
3—Sediment and foreign matter will settle out as the oil is bypassed back to the hopper tank.
4—The bypass pump will open and the oil pump will then supply unfiltered oil direct to the engine.

**8455.** Why is it important to periodically change engine lubricating oils?

1—Due to heat and oxidation oil loses its ability to maintain a film under load.
2—Oil becomes contaminated with finely divided solid particles suspended in the oil, causing excess wear.
3—The oil eventually wears out and crystalizes.
4—Unvaporized gasoline eventually dilutes the oil, causing it to wash off the bearing surfaces.

**8456.** Large reciprocating engine oil systems may be equipped with a flow control valve. What is the purpose of this valve?

1—To direct oil through, or around the oil cooler.
2—Deliver cold oil to the hopper tank.
3—Relieve excessive pressures in the oil cooler.
4—Control the volume of oil returned from the engine to the hopper tank.

**8457.** Under what conditions will the oil cooler automatic bypass valve be full open?

1—Engine oil at normal operating temperature.
2—Engine oil above normal operating temperature.
3—Engine oil below normal operating temperature.
4—Engine stopped, with no oil flowing after runup.

**8458.** In normally operated radial engines, what is the primary source of oil contamination?

1—Metallic deposits from normal engine wear.
2—Dust from runways, taxiways, and pollution.
3—Migratory combustion deposits from combustion chambers and cylinder walls.
4—Decomposition from oxidation and molecular break down from repeated heating and cooling of the oil.

**8459.** Which magneto check indicates a short (grounded) circuit between the right magneto and the ignition switch?

1—BOTH-1,700 RPM, R-1,625 RPM, L-1,700 RPM, OFF-1,625 RPM.
2—BOTH-1,700 RPM, R-0 RPM, L-1,700 RPM, OFF-0 RPM.
3—BOTH-1,700 RPM, R-1,625 RPM, L-1,675 RPM, OFF-1,625 RPM.
4—BOTH-1,700 RPM, R-0 RPM, L-1,675 RPM, OFF-0 RPM.

**8460.** If an aircraft engine continues to run normally after the ignition switch is turned off, what malfunction is indicated?

1—Fuel leaking to the carburetor.
2—Loose ground (P lead) from the magneto.
3—Internal magneto failure.
4—Failure to turn off the battery (master) switch.

**8461.** (Refer to figure 39.) What is the new CG position after removing the weight under operating conditions No. 2?

1—20.3 percent.
2—21.4 percent.
3—26.3 percent.
4—27.5 percent.

**8462.** When performing a magneto check on ground run up, what indicates a properly functioning magneto system?

1—Decrease in manifold pressure when not on both.
2—Increase in RPM when switched to left or right.
3—No change in RPM, when switched to left or right.
4—Slight drop in RPM when switched to left or right.

**8463.** On a large reciprocating engine, what would indicate defective spark plugs?

1—Intermittent engine miss at high speed only.
2—Intermittent engine miss at low speed only.
3—Consistent engine miss at full rich mixture, smoothing out with leaning.
4—Intermittent engine miss at all speeds.

**8464.** Which is an advantage of a dual ignition system as installed on reciprocating aircraft engines?

1—Permits the use of lower fuel grades at low altitude.
2—Increases the intensity of the ignition spark.
3—Increases spark plug life by dividing up ignition load between two lugs.
4—Increases the power output of the engine.

**8465.** Some large reciprocating engines are equipped with a carburetor containing a derichment valve and a derichment jet which add a cooling fluid. What is this system called?

1—Water evaporative additive.
2—Freon/water injection system.
3—Ethylene-Glycol dispersant.
4—ADI (anti-detonant injection).

**8466.** What does the fluid used in water injection systems consist of?

1—Water and benzine.
2—Alcohol and water.
3—Potassium dichromate and water.
4—Ethylene-glycol and water.

**8467.** If the water injection switch is activated when the engine is not running, how will this affect the derichment valve?

1—The valve will close from the water pressure.
2—The valve will open by means of an electric solenoid.
3—The valve will not actuate.
4—The valve will close if fuel pressure is available.

**8468.** In addition to providing an increase in the maximum available manifold pressure, water injection allows

1—continuous operation above METO power.
2—operation at maximum available power for the entire period the water injection is operational.
3—the engine to increase power without changing manifold pressure and RPM settings.
4—an increase in cruising range by replacing part of the fuel/air mixture with the anti-detonant.

**8469.** When used in large reciprocating engines, how does a water injection system increase available power?

1—Increasing the molecular weight of the fuel/air charge.
2—Suppressing detonation to higher manifold pressures.
3—Improving the volumetric efficiency of the engine.
4—Increasing the burn rate of the fuel/air charge.

**8470.** If an aircraft engine is not equipped with an altitude and temperature compensating carburetor, what affect will this have on the fuel/air mixture?

1—Mixture will lean as altitude or temperature increases.
2—Mixture will richen as altitude increases, and lean as temperature increases.
3—Mixture will richen as altitude or temperature increases.
4—Mixture will lean as altitude increases and richen as temperature decreases.

**8471.** What is the function of an altitude mixture control?

1—Regulates enrichment of the mixture entering the engine.
2—Regulates air intake above the fuel chamber.
3—Maintains constant air pressure in the venturi.
4—Determines volume of the main airflow to the engine.

**8472.** When a reciprocating engine utilizes a continuous-flow fuel injection system

1—fuel is injected directly into each cylinder.
2—fuel is injected at each cylinder intake port.
3—the injection system must be timed to the engine.
4—two injector nozzles are used, one for high speed and one for low speed operations.

**8473.** (Refer to figure 40.) What is the loaded CG in percent of MAC under operating conditions No. 1?

1—24.8 percent.
2—25.8 percent.
3—26.3 percent.
4—26.5 percent.

**8474.** On large reciprocating aircraft engines equipped with continuous cylinder fuel injection systems, on which stroke(s) is fuel normally discharged into each cylinder head intake valve port?

1—Intake.
2—Compression.
3—Intake and compression.
4—All strokes (continuously).

**8475.** During operation of an airplane engine equipped with a direct cylinder fuel injection system, which is least likely to occur?

1—Torching.
2—Afterfiring.
3—Starting kickback.
4—Backfiring.

**8476.** When priming a nine-cylinder radial aircraft engine using a multiple-point priming system and a central spider, how many cylinders will receive priming?

1—Five.
2—All cylinders.
3—Three
4—Four.

**8477.** Variation in engine requirements results in the fuel/air ratio changing with brake horsepower. What mixture is used at the rated power setting?

1—Leaner than the mixture used at the low horsepower and idling ranges.
2—Richer than the mixture used at normal cruise and idling ranges.
3—Richer than the mixture used at lower power settings above idle.
4—Richer than the mixture used through the normal cruise range, and leaner than the idle mixture.

**8478.** Under which conditions would an aircraft engine run lean, even though a normal amount of fuel is available?

1—Operating at idle RPM.
2—Using higher than specified octane fuel rating.
3—Incomplete fuel vaporization.
4—Carburetor heat valve in the HOT position.

**8479.** When starting a reciprocating engine, use of less than the normal throttle opening will cause

1—a rich mixture.
2—excessive lean starting mixture.
3—backfiring due to lean mixtures.
4—pre-ignition.

**8480.** What will cause engine power output to be reduced at all flight altitudes?

1—Increased air density.
2—Increase in humidity.
3—Increased manifold pressure.
4—Decrease in free-air temperature.

**8481.** What control positions are used when starting an aircraft engine equipped with a pressure carburetor?

1—Mixture control at the IDLE-CUTOFF position and the primer engaged.
2—Mixture control positioned at AUTO-RICH.
3—Mixture positioned at FULL-RICH, primer disengaged.
4—Primer engaged, mixture set FULL-LEAN.

**8482.** What is the best way to increase engine power and control detonation and pre-ignition?

1—Enrich the fuel/air mixture.
2—Water injection.
3—Lean the fuel/air mixture.
4—Increase the throttle setting.

**8483.** Air density is important when establishing the correct fuel-to-air ratio. Which weighs the most?

1—A mixture of 98 parts dry air and two parts water vapor.
2—A mixture of 75 parts dry air and 25 parts water vapor.
3—100 parts dry air.
4—100 parts water vapor.

**8484.** What constitutes a fuel/air mixture ratio of 11:1?

1—One part fuel to 11 parts air.
2—One part air to 11 parts fuel.
3—A ratio too rich for combustion.
4—A ratio too lean for combustion.

**8485.** When the engine fuel shutoff valve is activated, where in the system is the fuel shut off?

1—Immediately aft of the firewall.
2—At the outlet port of the carburetor.
3—At the outlet port of the fuel pump.
4—Between the fuel pump and carburetor inlet.

**8486.** (Refer to figure 41.) What minimum cargo weight must be shifted from the aft to the forward cargo location to bring the CG within the limits specified under operating conditions No. 2?

1—741 pounds.
2—1,222 pounds.
3—1,310 pounds.
4—1,570 pounds.

**8487.** (Refer to figure 41.) To bring the CG within the limits of operating conditions No. 3, what minimum weight must be shifted from the forward to the aft cargo hold?

1—122 pounds.
2—775 pounds.
3—1,160 pounds.
4—2,086 pounds.

**8488.** Which is the primary purpose for utilizing boost pumps in the fuel system?

1—Prevent unporting of fuel on takeoff.
2—Provide fuel transfer between tanks to prevent fuel imbalance.
3—To make fuel available from secondary tanks which are incapable of gravity feed.
4—Provide a positive fuel flow to the engine pump.

**8489.** Where, in the aircraft fuel system, is the main fuel strainer usually located?

1—Downstream from the wobble pump check valve.
2—Downstream of the carburetor strainer.
3—At the lowest point in the fuel system.
4—At a point in the fuel system that is lower than the carburetor strainer, but higher than the finger strainer.

**8490.** Where must a fuel strainer, or filter be located?

1—At the tank outlet and at the boost pump outlet.
2—Between the throttle body and carburetor fuel chamber.
3—Between the fuel metering device and tank outlet.
4—At the inlet to the engine driven fuel pump.

**8491.** When a turbine-engine-powered airplane, used by an air carrier, is to be ferried to another base for repair of an inoperative engine, which operational requirement must be observed?

1—The computed takeoff distance to reach $V_1$ must not exceed 70 percent of the available runway determined with all engines operating.
2—Only required crewmembers, or company personnel such as deadhead crewmembers, may be on board the airplane.
3—Only required crewmembers may be on board the airplane.
4—Takeoff weight may not exceed 65 percent of the maximum certificated takeoff weight.

**8492.** Which is a reason for using a crossfeed fuel system?

1—Provide defueling capability.
2—To be able to purge any fuel tank.
3—To jettison fuel during emergencies.
4—Help maintain aircraft stability.

**8493.** When applied to a reciprocating engine induction system, where is de-icing alcohol usually injected?

1—Directly into the supercharger, or impeller section.
2—Into the airstream ahead of the carburetor.
3—Into the low-pressure area ahead of the throttle valve.
4—Directly into the fuel system ahead of the discharge nozzle.

**8494.** If a normally aspirated reciprocating engine is equipped with a constant speed propeller and carbureted fuel system, what is the first indication of carburetor ice?

1—A decrease in power output with no change in manifold pressure, or propeller RPM.
2—An increase in manifold pressure and propeller RPM remains constant.
3—Manifold pressure decreasing and propeller RPM remains constant.
4—Manifold pressure decreasing and propeller RPM also decreasing commensurately.

**8495.** When in flight, which part of the aircraft will first accumulate ice?

1—Wing leading edges.
2—Propeller spinner, or dome.
3—Nose and fuselage of multiengine airplanes.
4—Carburetor.

**8496.** When carburetor heat is applied, you observe an increase in manifold pressure. What does this indicate?

1—Excessive heat being applied.
2—Ice has formed in the carburetor.
3—The mixture was set too lean.
4—The mixture was set too rich.

**8497.** While performing the ground check of a large reciprocating engine with a single-state, two speed supercharger, you shift from low impeller ratio to high impeller ratio. What will indicate normal operation?

1—An increase in RPM with a momentary drop in oil pressure, and an increase in manifold pressure.
2—Oil and manifold pressure will remain unchanged with an increase in RPM.
3—Manifold pressure, oil pressure, and RPM will all show a marked decrease.
4—Oil and manifold pressure will drop, RPM will remain unchanged, and fuel pressure will increase slightly.

**8498.** Which occurs with an increase in manifold pressure?

1—The volume of air in the cylinder increases.
2—Weight of the fuel/air charge decreases.
3—Air density in the cylinder increases.
4—The volume of air in the cylinder decreases.

**8499.** (Refer to figure 42.) What is the maximum payload under operating conditions No. 2?

1—36,430 pounds.
2—40,990 pounds.
3—57,090 pounds.
4—62,600 pounds.

**8500.** (Refer to figure 42.) Compute the maximum payload under operating conditions No. 3.

1—43,590 pounds.
2—45,910 pounds.
3—50,000 pounds.
4—57,090 pounds.

**8501.** Which is correct with regard to the volumetric efficiency of a reciprocating engine equipped with an internal supercharger?

1—Volumetric efficiency will remain the same throughout all throttle settings.
2—It is impossible to exceed 100 percent volumetric efficiency of any reciprocating engine regardless of the type of supercharger being used.
3—Manifold pressure will increase proportionately with horsepower.
4—You may exceed 100 percent volumetric efficiency of some reciprocating engines when equipped with certain superchargers.

**8502.** If an engine equipped with an external turbocharger is started with the waste gate closed, what may result?

1—Damage to the turbocharger intercooler cores.
2—Turbocharger overspeed resulting in damage to the pistons and rings.
3—Major damage due to overboost.
4—Nothing at throttle start position, but caution is required if the throttle is advanced.

**8503.** When the waste gate of a turbosupercharged engine is closed, what may be expected?

1—None of the gases are directed through the turbine.
2—Manifold pressure will be lower than normal.
3—The turbosupercharger is automatically turned off when the waste gate is closed to prevent internal damage.
4—All exhaust gases are directed through the turbine.

**8504.** Which most correctly describes Boost Manifold Pressure?

1—Manifold pressure from 0 to 14.7 Hg.
2—Manifold pressures between 14.7 Hg and 30 Hg.
3—Any manifold pressure above 30 Hg.
4—Any manifold pressure above of at least 40 Hg.

**8505.** When used on turbocharged aircraft, what is the purpose of the density controller?

1—Provides constant air velocity at the carburetor inlet.
2—Limits the maximum manifold pressure available at less than full throttle settings.
3—Limits the maximum full throttle manifold pressure.
4—Provides proper fuel/air mixture at all manifold pressures up to full throttle operations.

**8506.** When used in a turbocharger system, what is the purpose of the rate-of-change controller?

1—Limits maximum manifold pressure at full throttle.
2—Limits maximum manifold pressure at settings less than full throttle.
3—Controls rate of turbocharger discharge pressure increase.
4—Controls waste gate position at critical altitude and above.

**8507.** What regulates the speed of a turbosupercharger?

1—Turbine speed.
2—Compressor speed.
3—Waste gate position.
4—Throttle setting.

**8508.** What is the purpose of a turbocharger system?

1—Provides compressed air for cabin altitude after the aircraft has reached critical altitude.
2—Maintains constant air velocity in the intake manifold.
3—Compresses air to provide constant sea level manifold pressure to the critical altitude.
4—Maintains variable air pressure to the carburetor.

**8509.** What are the three basic regulating components of a sea-level boosted turbocharger system?

1—Exhaust bypass assembly, differential pressure controller, and compressor.
2—Density controller, differential pressure controller, and exhaust bypass assembly.
3—Pump/bearing case, density controller, and exhaust bypass assembly.
4—Compressor assembly, pump/bearing case, and exhaust bypass assembly.

**8510.** When utilized in a turbocharger system, what function does a differential pressure controller serve?

1—Reduces bootstrapping during part-throttle operations.
2—Positions waste gate valve for optimum power output.
3—Maintains a constant fuel/air ratio to the induction system.
4—Positions waste gate for minimum exhaust back pressure.

**8511.** What is the purpose of a pressure ratio controller when used in a turbocharger system?

1—Positions the waste gate at critical altitude and above.
2—Positions the waste gate from sea level to critical altitude.
3—Determines the rate of turbocharger discharge pressure.
4—Determines the volume of turbocharger discharge pressure.

**8512.** (Refer to figures 43 and 44.) What is the aircraft weight at the end of cruise operations under condition No. 1?

1—120,650 pounds.
2—121,800 pounds.
3—122,400 pounds.
4—135,400 pounds.

**8513.** (Refer to figures 43 and 44.) Compute the aircraft weight at the completion of a cruise flight under conditions No. 1.

1—94,400 pounds.
2—100,860 pounds.
3—101,900 pounds.
4—110,900 pounds.

**8514.** What drives an externally driven supercharger?

1—Engine oil pressure.
2—Gear drive off the crankshaft.
3—Exhaust gases driving a turbine.
4—Belt/pulley assembly driven off the accessory case.

**8515.** Which three units comprise a typical turbosupercharger?

1—Density controller, compressor assembly, and differential pressure controller.
2—Compressor assembly, exhaust gas turbine assembly, and pump/bearing case.
3—Density controller, differential pressure controller, and pump/bearing case.
4—Differential pressure controller, density controller, and compressor assembly.

**8516.** Where does an electrical priming system obtain the fuel for prime?

1—Carburetor.
2—Oil dilution solenoid.
3—Boost pump outlet.
4—Direct from inboard fuel tanks.

**8517.** On a nine-cylinder radial engine utilizing a multiple point priming system, how many cylinders will receive priming?

1—Four.
2—Five.
3—Seven.
4—Nine.

**8518.** While starting a large engine you experience an induction fire which, after starting, continues to burn. How should this fire be extinguished?

1—Shut down the engine and use available fire-fighting equipment.
2—Continue running the engine until the fire is extinguished.
3—Call for assistance from the closest available ramp service.
4—Actuate the engine fire extinguishing agents, then exit the aircraft and call for ramp help.

**8519.** Should an induction fire start cranking a large reciprocating engine, what action would be the most appropriate?

1—Activate the firewall fuel shutoff and starve the fire.
2—Continue cranking the engine with the intent of inhaling the fire.
3—Backfire the engine to blow the fire out.
4—Shut down all switches and valves and leave the aircraft without delay.

**8520.** In addition to supplying air to the carburetor, what is another function of the carburetor air scoop?

1—Prevents ice formation.
2—Engine cooling.
3—Prevents vapor lock by cooling adjacent fuel lines.
4—Produces ram effect to increase incoming air pressure.

**8521.** Unless absolutely necessary, why is carburetor preheat not used for takeoff?

1—Possible detonation and loss of power.
2—Produces an excessive drain on the electrical system.
3—Increases probability of vapor lock.
4—Lowers the high end octane value of the fuel, causing poor ignition and possible plug fouling.

**8522.** Why are baffles and deflectors installed around the cylinders of air-cooled engines?

1—To force cooling air into contact with all parts of the cylinder.
2—Produce low-pressure areas to decrease the velocity of the cooling air for better heat exchange.
3—Create high pressure in front of the cylinders.
4—Provide access to the engine parts and hold the nacelle off the engine to avoid heat transfer.

**8523.** Why do some reciprocating engine systems use exhaust augmentors?

1—Reduce exhaust back pressure.
2—Aid in engine cooling airflow.
3—Quickly displace exhaust gases.
4—Augment the rapid dissipation of exhaust gases.

**8524.** On air cooled reciprocating engines, where are cooling fins usually found?

1—On the exhaust side of the cylinder head, connecting rods, and cylinder walls.
2—Inside the pistons and connecting rods, and on the exhaust side of the cylinder head.
3—Inside the piston skirt, on cylinder walls, and in the cylinder head.
4—On the cylinder head, cylinder barrel, and inside the piston head.

**8525.** During ground operation of large radial engines, in what position should the cowl flaps be placed?

1—Fully closed.
2—Fully open.
3—Fully closed until operating temperature is reached, then full open.
4—Partly opened to establish desired cylinder head temperature, then adjust to maintain that temperature.

**8526.** During an operational check of electrically powered cowl flaps, the flap motor fails to operate. Which should be checked first?

1—Flap actuator motor circuit breaker.
2—Cockpit control switch in the on position.
3—Flap actuator jackscrew synchronization switch on.
4—Flap actuator motor connectors.

**8527.** (Refer to figures 45 and 46.) What is the minimum torque required for takeoff under operating conditions No. 1?

1—12,400 inches per pound.
2—16,600 inches per pound.
3—18,000 inches per pound.
4—18,300 inches per pound.

**8528.** (Refer to figures 45 and 46.) Determine the minimum torque required for takeoff under operating conditions No. 2.

1—15,000 inches per pound.
2—14,400 inches per pound.
3—13,800 inches per pound.
4—12,400 inches per pound.

**8529.** What happens to the greatest portion of combustion heat generated in reciprocating engines?

1—The heat energy is converted to work.
2—Combustion heat is removed via the oil system.
3—It is carried out of the system by exhaust gases.
4—It is dissipated normally through the cylinder walls and heads.

**8530.** If a large reciprocating engine shows an overheat condition after taxi, what operational procedure should be used to cool the cylinders?

1—Operate the engine at low RPM with the oil dilution system activated.
2—Operate the engine at idle RPM until the temperature decreases.
3—Use a high RPM setting with mixture in lean position.
4—Use a high RPM setting with mixture in full rich position.

**8531.** Why are the cylinder rows of a twin-row radial engine offset (staggered) to each other?

1—Facilitate better cooling of the cylinder heads.
2—Permit the use of a common dynamic damper.
3—Enable one cam gear to operate both rows of cylinders.
4—The front plugs of both rows can be fired on a common magneto.

**8532.** On engines equipped with turbosuperchargers, what is the purpose of an intercooler?

1—Cool the exhaust gases before they contact the turbo drive wheel.
2—Cool the supercharger bearings.
3—Cool the mixture of fuel/air entering the internal supercharger.
4—Cool the air entering the carburetor from the supercharger.

**8533.** Which best describes a cylinder muff?

1—A device to absorb sound and reduce engine operational noise.
2—A heating shroud used to provide cabin heat.
3—Separate sleeve of aluminum cooling fins shrunk to a steel inner cylinder sleeve.
4—Cooling jacket for liquid-cooled engines.

**8534.** When installed on aircraft engines, what purpose do blast tubes serve?

1—Provide a means of cooling the engine by utilizing propeller backwash.
2—A device augmenting the thrust value of the exhaust.
3—The tube used to load a cartridge starter.
4—A device to provide cooling to an engine accessory.

**8535.** Which will result in a decrease in volumetric efficiency?

1—Low cylinder head temperature.
2—Low carburetor air temperature.
3—Part throttle operation.
4—Full throttle operation.

**8536.** What is the source of heat to operate a carburetor air intake heater?

1—Electric heating elements.
2—Ducting off the cabin heater.
3—Gasoline combustion heater ducted to the carburetor.
4—Exhaust gases.

**8537.** Name two general types of exhaust systems found on reciprocating engines?

1—Bifurcated duct arrangement and long stacks.
2—Short stacks and collectors.
3—Shroud system and long stacks.
4—Bifurcated duct arrangement and shroud system.

**8538.** Augmentor tubes are found on what part of a reciprocating engine?

1—Induction system.
2—Oil system.
3—Exhaust group.
4—Fuel distribution.

**8539.** In the propeller deicing system, how is electrical power transferred to the propeller hub assembly?

1—Use of slip rings and segment plates.
2—Through slip rings and carbon brushes.
3—By collector rings and transducers.
4—Through flexible electrical connectors.

**8540.** On aircraft equipped with liquid propeller anti-icing systems, how is the anti-icing fluid ejected from the slinger ring?

1—Through ejector pumps in the propeller dome.
2—Use of pump pressure from the deicing fluid tank.
3—By centripetal force.
4—By centrifugal force.

**8541.** On most multiengine aircraft, how is automatic propeller synchronization accomplished?

1—Activating blade switches.
2—Adjusting throttle levers.
3—Sensing of propeller governors.
4—Adjusting propeller control levers.

**8542.** (Refer to figure 47.) What is the total fuel burn under operating conditions No. 2?

1—12,600 pounds.
2—16,700 pounds.
3—18,130 pounds.
4—24,050 pounds.

**8543.** (Refer to figure 47.) Compute the total fuel burn under operating conditions No. 3.

1—23,150 pounds.
2—19,200 pounds.
3—17,850 pounds.
4—16,130 pounds.

**8544.** What fluid is generally used in propeller anti-icing systems?

1—Ethylene glycol.
2—Isopropyl alcohol.
3—Denatured alcohol.
4—Ethyl alcohol.

**8545.** When aircraft engines are under synchronizer control, what detects engine speed differences?

1—Master override relay.
2—Propeller governor.
3—Blade switches.
4—Master motor.

**8546.** On multiengine aircraft, what is a function of the automatic propeller synchronizing system?

1—Reduce noise and increase vibration.
2—Control the tip speed of the propellers to avoid drift into the supersonic range.
3—Control engine RPM and reduce vibration.
4—Control the power output of each engine.

**8547.** When monitoring a propeller deicing system for proper operation, which indicator should be observed?

1—Voltmeter.
2—Cycle indicator lights.
3—Ohmmeter.
4—Ammeter.

**8548.** Which unit of the propeller anti-icing system controls the output of the pump.

1—Pressure relief valve.
2—Rheostat.
3—Cycling timer.
4—Current limiter.

**8549.** How should propeller deicing boots be checked for proper operation?

1—By observing the ammeter, or loadmeter for proper current flow.
2—Feeling the boots for heating while observing the cyclic flickering of the ammeter.
3—Timing the inflation/deflation sequences.
4—Observing evidence of deicing fluid during operational cycles?

**8550.** A large radial engine is equipped with a hydraulically controlled constant-speed propeller, set within the propeller's constant speed range, at a fixed throttle setting. If the tension of the propeller governor control spring (speeder spring) is reduced by movement of the propeller control, how will engine operation be affected?

1—Propeller blade angle will increase, manifold pressure will increase, and engine RPM will decrease.
2—Manifold pressure will increase, engine RPM will decrease, and propeller blade angle will decrease.
3—Engine RPM will increase, propeller blade angle will decrease, and manifold pressure will decrease.
4—Propeller blade angle will increase, manifold pressure will decrease, and engine RPM will increase.

**8551.** During engine operation at speeds lower than those for which the constant-speed propeller control can govern when in the INCREASE RPM position, how will the propeller be affected?

1—Remain in the LOW RPM position.
2—Remain in the HIGH PITCH position.
3—Will maintain engine RPM in the normal manner until the HIGH PITCH stop is reached.
4—Will remain in the full LOW PITCH position.

**8552.** What does the propeller governor control?

1—Oil to and from the pitch changing mechanism.
2—Movement of relief valves in the accumulator assembly.
3—Spring tension of the boost pump speeder spring.
4—Movement in and out of the linkage and counterweights.

**8553.** When equipped with a hydromatic, constant speed propeller, what happens when the cockpit control lever is actuated?

1—Tension on the speeder spring is changed.
2—Fluid transfer valve changes position.
3—The governor boost pump pressure is varied.
4—The governor bypass valve is positioned to direct oil pressure to the propeller dome.

**8554.** If tension on the propeller governor control spring (speeder spring) is increased, what will happen to the blade angle and engine RPM?

1—Propeller blade angle will increase and engine RPM will increase.
2—Engine RPM will decrease and propeller blade angle will decrease.
3—Propeller blade angle will increase and engine RPM will decrease.
4—Engine RPM will increase and propeller blade angle will decrease.

**8555.** When in flight, how is the speed of a hydromatic constant-speed propeller changed?

1—Varying the output of the governor boost pump.
2—Advancing the throttle to higher manifold pressures.
3—Changing the rotational speed of the governor pilot valve.
4—Changing the tension against governor flyweights.

**8556.** Centrifugal force acting upon the governor counterweights overcomes the tension on the speeder spring. What propeller speed condition will result?

1—Onspeed.
2—Underspeed.
3—In-between condition.
4—Overspeed.

**8557.** What operational force creates the greatest stress on a propeller?

1—Aerodynamic twisting force.
2—Centrifugal force.
3—Thrust bending force.
4—Torque bending force.

**8558.** (Refer to figure 48.) Under conditions No. 1, what cabin rate of climb is required to reach cruise altitude and desired cabin altitude at the same time?

1—264 feet per minute.
2—281 feet per minute.
3—300 feet per minute.
4—313 feet per minute.

**8559.** (Refer to figure 48.) What cabin rate of climb would be required to reach cruising altitude and desired cabin altitude simultaneously under operating conditions No. 2?

1—153 feet per minute.
2—170 feet per minute.
3—195 feet per minute.
4—206 feet per minute.

**8560.** (Refer to figure 48.) Compute the rate of climb necessary to reach cruise altitude and desired cabin altitude at the same time while operating under conditions No. 3.

1—650 feet per minute.
2—605 feet per minute.
3—528 feet per minute.
4—500 feet per minute.

**8561.** Which force will increase propeller blade angle?

1—Centrifugal twisting force.
2—Aerodynamic twisting force.
3—Thrust bending force.
4—Torque bending force.

**8562.** What affect does aerodynamic twisting force have on operating propeller blades?

1—Attempts to bend the blades opposite to the direction of rotation.
2—Turns the blades to a higher blade angle.
3—Bends the blades forward from tractor resistance.
4—Turns the blades to a lower blade angle.

**8563.** What blade movement occurs when a hydromatic propeller is set in the high RPM position and reversing action is begun?

1—Low pitch directly to reverse pitch.
2—No blade movement occurs since this propeller cannot be reversed from the high RPM position.
3—Low pitch to high pitch to reverse pitch action.
4—Low pitch through feather, then into reverse.

**8564.** Propeller blade angle is defined as the acute angle between the airfoil section chord line (at the blade reference station) and the

1—plane of rotation.
2—relative wind.
3—propeller thrust line.
4—axis of blade rotation during pitch change.

**8565.** When equipped with a constant-speed propeller, which flight conditions will result in the greatest blade pitch angle?

1—Approach to landing.
2—Initial climbout.
3—High-speed, high-altitude cruise flight.
4—Takeoff roll at sea level.

**8566.** A hydromatic propeller is feathered, then immediately unfeathers itself. What would most likely cause this problem?

1—The governor is not cutting out in high pitch.
2—Dome pressure relief valve is stuck closed.
3—Distributor relief valve is stuck closed.
4—Pressure cutout switch is stuck closed.

**8567.** What nomenclature is given to the actual distance a propeller moves through the air during one revolution?

1—Effective pitch.
2—Geometric pitch.
3—Relative pitch.
4—Resultant pitch.

**8568.** An aircraft engine is developing cruise power with the propeller operating in the constant-speed range. What will occur if the throttle is moved?

1—Opening the throttle will cause an increase in blade angle.
2—Closing the throttle will cause an increase in blade angle.
3—RPM will vary directly up or down with any movement of the throttle.
4—Throttle movement will not affect blade angle.

**8569.** From what datum are propeller blade stations measured?

1—Index mark on the blade shank.
2—Hub centerline.
3—Blade case.
4—Blade tip.

**8570.** How is thrust produced from a rotating propeller?

1—As a by-product of propeller slippage.
2—From an area of low pressure behind the blades.
3—From an area of decreased pressure immediately in front of the blades.
4—By the angle of relative wind and rotational velocity of the propeller.

**8571.** When stopping a constant-speed counterweight propeller, why is it normally placed in the HIGH PITCH position?

1—Prevent exposure and corrosion of the pitch changing mechanism.
2—Prevent hydraulic lock when the oil cools.
3—Prevent overheating the engine at the next start.
4—Facilitate rapid reduction of engine operating temperatures prior to shutdown.

**8572.** What effect does the centrifugal twisting moment have upon an operating propeller?

1—Increases the pitch angle.
2—Reduces the pitch angle.
3—Bends the blades in the direction of rotation.
4—Bends the blades rearward to the line of flight.

**8573.** (Refer to figure 49.) What is the loaded CG in percent of MAC under operating conditions No. 2?

1—19.4 percent.
2—21.8 percent.
3—22.3 percent.
4—23.2 percent.

**8574.** (Refer to figure 49.) Determine the loaded CG in percent of MAC under conditions No. 3.

1—32.0 percent.
2—30.5 percent.
3—29.9 percent.
4—28.9 percent.

**8575.** What term identifies the cambered side of a propeller blade?

1—Back.
2—Chord.
3—Leading edge.
4—Face.

**8576.** Which best describes the blade movement of a full-feathering constant-speed propeller that is in the LOW RPM position when the feathering action is begun?

1—High pitch through low pitch to feather.
2—Low pitch directly to feather.
3—High pitch directly to feather.
4—Low pitch through high pitch to feather.

**8577.** What causes the blades of a constant-speed counterweight propeller to move to the HIGH PITCH position?

1—Engine oil pressure acting on the propeller piston-cylinder unit.
2—Engine oil pressure acting on the propeller piston-cylinder unit in combination with centrifugal force acting on the counterweights.
3—Centrifugal force alone acting on the counterweights.
4—Prop governor oil pressure acting on the propeller piston-cylinder unit.

**8578.** Which best describes the blade movement of a feathering propeller set in the HIGH RPM position when the feathering action is begun?

1—High pitch through low pitch, to feather.
2—Low pitch through reverse, to feather.
3—No movement, because feathering cannot be accomplished from the HIGH RPM control position.
4—Low pitch through high pitch, to feather.

**8579.** You are performing a ground check on a large reciprocating engine equipped with a hydromatic, full-feathering propeller. You notice that after pushing the feather button, it remains depressed until feathering is complete, then opens. What does this indicate?

1—Feather cycle is functioning normally.
2—A malfunction of the feather switch is indicated.
3—The feather cycle sequence is incorrect.
4—The depressed switch indicates a sticking accumulator and maintenance should be notified before the next flight.

**8580.** You are proceeding to unfeather a hydromatic propeller installed on a large radial engine. You notice it is necessary to hold the button down continuously until unfeathering is complete. This is

1—an indication of unfeathering accumulator malfunction.
2—the normal unfeathering procedure.
3—the result of too low engine oil pressure during the unfeathering phase causing slow dome response.
4—an indication that engine oil pressure to the propeller governor is insufficient for proper function.

**8581.** What controls the constant-speed range of a constant-speed propeller?

1—Engine RPM.
2—Angle of climb, or descent, and airspeed changes.
3—Total number of propeller blades.
4—Mechanical limits within the propeller pitch range.

**8582.** When comparing a constant-speed-counterweight propeller with a two-position counterweight propeller, which is correct?

1—Blade angle changes are accomplished by both hydraulic and centrifugal forces.
2—A range of blade angle travel of either 15 degrees, or 20 degrees is available.
3—An infinite number of blade angles are available on either propeller.
4—The pilot selects the RPM desired and the propeller changes pitch to maintain the selected RPM.

**8583.** Most engine/propeller combinations have a critical range within which continuous operation is not permitted. Why should you observe these limitations?

1—To avoid severe propeller vibration.
2—To eliminate the possibility of severe turbulence within the slipstream over wings and control surfaces.
3—To prevent low, or negative thrust conditions.
4—To avoid inefficient propeller blade/pitch angles.

**8584.** After landing on a debris covered runway, you notice several nicks on the propeller leading edges. Why is it important to have these nicks removed as soon as possible?

1—Localize vibratory stress factors.
2—Prevent horizontal imbalance conditions.
3—Improve the aerodynamic conditions of the blades.
4—Eliminate locations where fatigue cracks can start.

**8585.** What is the primary purpose of a propeller cuff?

1—Aid in distribution of anti-icing fluids.
2—Strengthen the propeller.
3—Reduce drag.
4—Increase the flow of cooling air to the nacelles.

**8586.** (Refer to figure 50.) What is the new CG position after adding weight under operating conditions No. 2?

1—18.8 percent.
2—21.9 percent.
3—23.0 percent.
4—23.6 percent.

**8587.** (Refer to figure 50.) Determine the new CG position after adding weight under operating conditions No. 3.

1—10.4 percent.
2—18.3 percent.
3—20.8 percent.
4—24.7 percent.

**8588.** What is the primary purpose of a propeller?

1—Create lift on the fixed airfoils of the aircraft.
2—Build up slipstream to support the airfoils.
3—Convert engine horsepower to thrust.
4—Develop horsepower to move the aircraft.

**8589.** How does a constant-speed propeller provide maximum efficiency?

1—Increasing blade pitch as aircraft speed decreases.
2—Adjusting blade angle for most conditions of flight.
3—Reducing turbulence near blade tips, maintaining sonic flow in those regions.
4—Increasing the lift coefficient of the propeller blades.

**8590.** What is the definition of propeller geometric pitch?

1—Effective pitch minus slippage.
2—Effective pitch plus slippage.
3—The angle between the blade chord and the plane of rotation.
4—The angle between the blade face and the plane of rotation.

**8591.** What operational force causes the propeller blade tips to lag in the opposite direction of rotation?

1—Thrust-bending force.
2—Aerodynamic-twisting force.
3—Centrifugal-twisting force.
4—Torque-bending force.

**8592.** What operational force causes the propeller blade tips to bend forward?

1—Torque-bending force.
2—Aerodynamic-twisting force.
3—Centrifugal-twisting force.
4—Thrust-bending force.

**8593.** During takeoff, utilizing a constant speed propeller, what are the rotational speed and blade pitch angle requirements?

1—Low-speed and low-pitch angle.
2—Low-speed and high-pitch angle.
3—High-speed and low-pitch angle.
4—High-speed and high-pitch angle.

**8594.** When a hydromatic propeller has been feathered, by what means is the oil pressure delivery stopped?

1—Pulling the feather button.
2—Through an electric cutout pressure switch.
3—High-angle stop ring in the base of the fixed cam.
4—Stop lugs attached to the rotating cam.

**8595.** When equipped with a hydraulically operated constant speed propeller, magneto checks are accomplished with the propeller in which position?

1—High RPM.
2—Normal cruise setting.
3—Low RPM.
4—High pitch.

**8596.** What does it mean to manually feather a hydromechanical propeller?

1—Block governor oil pressure to the cylinder of the propeller.
2—Port governor oil pressure to the propeller cylinder.
3—Port governor oil pressure from the propeller cylinder.
4—Block governor oil pressure in the propeller cylinder.

**8597.** With regard to the propeller-feathering pump, which is correct?

1—The pump is shut off 15 seconds after depressing the feather button.
2—A micro switch in the propeller governor shuts off the feathering pump at the appropriate time.
3—The propeller feathering pump is shut off by an oil pressure switch.
4—Pump shutoff is accomplished when the propeller piston activates the limiter switch.

**8598.** Concerning Bernoulli's principle, which is true?

1—The pressure of a fluid increases at points where the velocity of the fluid increases.
2—The pressure of a fluid decreases at points where the velocity of the fluid increases.
3—It has no practical application to turboprop aircraft.
4—Bernoulli's principle applies only to lifting action of the flight surfaces.

**8599.** While starting a turboprop engine, the turbine inlet temperature exceeds the specified maximum during the start sequence. What action should be taken?

1—Turn off the fuel and ignition switches, discontinue the start and investigate the situation.
2—Advance the power lever and watch for excessive smoke, if present, discontinue the start attempt.
3—Continue the start since temperatures will stabilize as soon as 5,000 RPM, or 10 percent power is reached.
4—Turn off the fuel and ignition switches, discontinue the start, then wait 5 minutes and initiate another start sequence.

**8600.** (Refer to figure 51.) What minimum weight of cargo must be shifted from the aft to the forward cargo location to bring the CG within limits under operating conditions No. 2?

1—4,690 pounds.
2—500 pounds.
3—470 pounds.
4—278 pounds.

**8601.** (Refer to figure 51.) Compute the minimum cargo weight to be shifted from the forward to the aft cargo holds to bring the CG within limits as outlined under operating conditions No. 3.

1—620 pounds.
2—645 pounds.
3—945 pounds.
4—6,350 pounds.

**8602.** At 5,000 RPM, during the start sequence, neither the reduction gear or the power unit indicate any oil pressure. What action should be taken?

1—Turn off the ignition and fuel switches, discontinue the start, and have the oil pressure gauge checked.
2—Turn off the ignition and fuel switches, let the engine motor for 2 minutes, then restart.
3—Turn off the ignition and fuel switches, discontinue the start and initiate an investigation into the cause.
4—Turn off the ignition and fuel switches, discontinue the start, allow a cool down for 2 minutes, then attempt another start.

**8603.** Mixing aviation gasoline with jet fuel will have what affect on turbine powerplant efficiency?

1—No disadvantages.
2—The tetraethyl lead in the gasoline forms deposits on the turbine blades.
3—The tetraethyl lead in the gasoline forms deposits on the compressor blades.
4—Continuous use in rations not exceeding 1 to 4 will not affect engine efficiency.

**8604.** What action should be taken if jet fuel is contaminated with aviation gasoline?

1—Determine the grade of gasoline, then contact the engine manufacturer for guidance.
2—Adjust the power lever to compensate for the lower octane.
3—Determine the amount of fuel put in the tanks and if under 25 percent of the total volume, do nothing. If over 25 percent, have the tanks drained and refilled.
4—Consult the aircraft operating handbook for acceptable ratios and operating limitations for mixed fuels.

**8605.** Which is correct concerning jet fuel contamination of a turbprop fuel system?

1—Jet fuel is of higher viscosity than other fuels; therefore, holds contaminants better.
2—Viscosity has no relationship to fuel contamination; therefore, all fuels suspend contaminants equally.
3—Jet fuel is less susceptible to contamination because it is filtered more often than gasolines.
4—Jet fuel has the lowest viscosity of all fuels, therefore cannot hold contaminants in any form.

**8606.** What is the identification color of turbine fuel?

1—Blue.
2—Green.
3—Straw.
4—Red.

**8607.** Both gasoline and kerosene have certain advantages for use as turbine fuel. Which is a true statement of these advantages?

1—Kerosene has a higher heat energy per unit weight than gasoline.
2—Gasoline is a better lubricant than kerosene (important in regard to fuel metering pumps).
3—Gasoline has a higher heat energy per unit volume than kerosene.
4—Kerosene has a higher heat energy per unit volume than gasoline.

**8608.** What is the purpose of a brake master cylinder?

1—Constantly maintain the correct volume of fluid in the hydraulic lines and brake components.
2—Transform mechanical motion to hydraulic pressure.
3—Provide a means for building up, varying, and releasing the hydraulic pressure required for brake operation.
4—Perform all of the above.

**8609.** What is the pressure source for power brakes?

1—The main hydraulic system.
2—The power brake reservoir.
3—A master cylinder.
4—Pressure being applied to the rudder pedals.

**8610.** With respect to aircraft equipped with hydraulically operated multiple-disc brake assemblies, which is correct?

1—There are no special operating limitations due to the use of self-compensating cylinder assemblies.
2—No emergency pressure systems are available with this type of brake system.
3—Do not set the parking brake when brakes are hot.
4—There are no provisions for a parking brake with this type of brake assembly.

**8611.** If an engine is inoperative, but the hydraulic system still has pressure, how would you determine the air pressure charge in the accumulator?

1—Read it directly from the main system pressure gauge with all actuators inoperative.
2—Build up the system pressure with the emergency pump and then read the pressure from a gauge attached to the air side of the accumulator.
3—Operate some hydraulic unit slowly and note the pressure at which a rapid pressure drop begins.
4—Build up the system pressure with the emergency pump. The system pressure gauge will remain at zero until the pressure equals accumulator air pressure, at which time the gauge reading will increase rapidly.

**8612.** Which section of a turboprop engine provides air for the pressurization and air conditioning systems?

1—Exhaust.
2—Compressor.
3—Combustion.
4—Intake.

**8613.** In a turboprop installation, which component of an air-cycle cooling system undergoes a pressure and temperature drop of air during operation?

1—Water separator.
2—Expansion turbine.
3—Primary heat exchanger.
4—Refrigeration bypass valve.

**8614.** In a freon vapor-cycle cooling system, where is coolant air obtained for the condenser?

1—Turbine engine compressor.
2—Ambient air.
3—Subcooler air.
4—Pressurized cabin air.

**8615.** (Refer to figures 52 and 53.) What is the takeoff power available under operating conditions No. 1?

1—3,600 SHP.
2—3,710 SHP.
3—3,770 SHP.
4—4,000 SHP.

**8616.** (Refer to figures 52 and 53.) Compute the takeoff power available under conditions No. 2?

1—2,900 SHP.
2—3,080 SHP.
3—3,130 SHP.
4—3,270 SHP.

**8617.** (Refer to figures 52 and 53.) What is the takeoff power available under operating conditions No. 3?

1—3,530 SHP.
2—3,630 SHP.
3—3,730 SHP.
4—4,000 SHP.

**8618.** Turbine engine air used for air conditioning and pressurization of the turboprop airplane is commonly called

1—compressed air.
2—ram air.
3—conditioned air.
4—bleed air.

**8619.** When the cabin pressure regulator is operating in the differential mode, reference pressure is vented to the atmosphere by the

1—dump valve.
2—relief valve.
3—isobaric metering valve.
4—differential metering valve.

**8620.** When the cabin pressure regulator is operating in the isobaric range, cabin pressure is maintained constant by

1—the movement of the regulator bellows.
2—limiting the flow of air to the cockpit.
3—the action of the cabin pressure safety valve.
4—limiting the air from the reference chamber.

**8621.** Which components make up the basic air-cycle cooling system?

1—A source of compressed air, heat exchangers, and a turbine.
2—Heaters, coolers, and compressor.
3—Ram air source, compressors, and engine bleeds.
4—Heat exchangers and evaporators.

**8622.** In a pressurized system, what is the purpose of the dump valve?

1—Relieve all positive pressure from the cabin.
2—Relieve a negative pressure differential.
3—Reduce the load on the compressors.
4—Reduce any pressures in excess of maximum cabin differential.

**8623.** In a pressurized turboprop airplane, capable of operating for sustained periods at altitudes greater than 31,000 feet, how is cabin pressure controlled?

1—By a valve that stops the pressurization pump when a pressure equivalent to the maximum safe cabin altitude has been reached.
2—By a pressure-sensitive switch that causes the pressurization pump to turn on or off as required.
3—By use of an automatic outflow valve that dumps all pressure in excess of the amount for which it is set.
4—By use of a pressure-sensitive valve that controls the output pressure of the pressurization pump.

**8624.** If auxiliary (ambient) ventilation is selected during pressurized flight and at cruise altitude, what will result?

1—An increase in cabin pressure.
2—Cabin compressor overspeed.
3—Increased cabin altitude.
4—Increased conditioned air efficiency.

**8625.** The cabin pressure control setting has a direct influence upon the

1—outflow valve opening.
2—cabin supercharger compression ratio.
3—pneumatic system pressure.
4—turbocompressor speed.

**8626.** Which component of a turboprop airplane pressurization system prevents the cabin altitude from becoming higher than airplane altitude?

1—Cabin rate of descent control.
2—Negative pressure relief valve.
3—Supercharger overspeed valve.
4—Compression ratio limit switch.

**8627.** If the cabin rate of climb is too great, how should the controls be adjusted?

1—Cause the outflow valve to close slower.
2—Allow an increase in cabin compressor speed.
3—Cause the outflow valve to close faster.
4—Allow a decrease in compressor speed.

**8628.** Which of the following prevents a loss of pressurization through a disengaged cabin air compressor installed in a turboprop airplane?

1—Firewall shutoff valve.
2—Supercharger disconnect mechanism.
3—Cabin pressure outflow valve.
4—Delivery air duct check valve.

**8629.** (Refer to figures 54 and 55.) What is the landing weight under operating conditions No. 1?

1—86,400 pounds.
2—87,750 pounds.
3—88,300 pounds.
4—89,650 pounds.

**8630.** (Refer to figures 54 and 55.) Compute the landing weight under operating conditions No. 2.

1—93,150 pounds.
2—92,875 pounds.
3—91,970 pounds.
4—90,600 pounds.

**8631.** (Refer to figures 54 and 55.) Determine the landing weight under operating conditions No. 3.

1—101,150 pounds.
2—102,580 pounds.
3—102,820 pounds.
4—103,200 pounds.

**8632.** The air-cycle cooling system produces cold air by

1—routing conditioned air through a cooling fan.
2—passing heated air through a compressor.
3—passing air through cooling coils that contain a volume of refrigerant.
4—extracting heat energy across an expansion turbine.

**8633.** An airplane is cruising at 8,000 feet, and the cabin altitude is stabilized at 3,000 feet utilizing manual controls after failure of the automatic controls. If the airplane climbs 500 feet and the manual control setting is not changed, the cabin altitude will

1—remain at 3,000 feet.
2—climb to 7,500 feet.
3—descend to 2,500 feet.
4—climb to 3,500 feet.

**8634.** A turboprop airplane fuselage is subjected to five major stresses. How would pressurization be classified?

1—Tension stress.
2—Compression stress.
3—Torsion load.
4—Shear stress loading.

**8635.** What are the operating cabin pressurization ranges of a pressurized turboprop airplane?

1—Isobaric, differential, and maximum differential.
2—Differential, unpressurized, and isobaric.
3—Ambient, unpressurized, and isobaric.
4—Unpressurized, differential, and ambient.

**8636.** Regarding the following statements, which are correct?

(a) Usually bleed air from a turbine engine compressor is free from contamination and can be used safely for cabin pressurization.

(b) Independent cabin compressors can be engine-driven through accessory drive gearing, or can be powered by bleed air from a turbine engine compressor.

1—Only statement (a) is correct.
2—Only statement (b) is correct.
3—Both (a) and (b) are correct.
4—Neither (a) nor (b) is correct.

**8637.** What controls the amount of oxygen delivered to a mask is a continuous-flow oxygen system?

1—Calibrated orifice.
2—Line valve.
3—Pressure reducing valve.
4—Pilots regulator.

**8638.** In the diluter-demand oxygen regulator, when does the demand valve operate?

1—When the diluter control is set at normal.
2—When the user demands 100 percent oxygen.
3—When the user breathes.
4—When the cylinder pressure is at least 500 pounds.

**8639.** What information is supplied by the green arc on an aircraft temperature gauge?

1—The instrument is not calibrated for that aircraft.
2—The desirable operating temperature range.
3—A lower, unusable temperature range.
4—A higher than normal temperature range.

**8640.** How can you determine if the cover glass on an instrument has slipped or rotated in the case?

1—The instrument markings will be unreadable.
2—The instrument will have a white index mark from which you can determine slippage.
3—Instruments are sealed and glass cannot slip in the case.
4—The instrument will jam and be unusable.

**8641.** Should the instrument static pressure line become disconnected inside a pressurized cabin during cruise flight, what will result?

1—The altimeter and airspeed indicator will both read low.
2—The altimeter and airspeed indicator will both read high.
3—The altimeter will read high and the airspeed will read low.
4—The altimeter will read low and the airspeed indicator will read high.

**8642.** (Refer to figure 56.) What cabin rate of climb is required to reach cruising altitude and the desired cabin altitude at the same time under operating conditions No. 4?

1—264 feet per minute.
2—281 feet per minute.
3—300 feet per minute.
4—313 feet per minute.

**8643.** (Refer to figure 56.) What cabin rate of climb is necessary to reach cruise altitude and desired cabin altitude at the same time under operating conditions No. 2?

1—153 feet per minute.
2—169 feet per minute.
3—195 feet per minute.
4—206 feet per minute.

**8644.** The operation of the angle of attack indicating system is based on detection of differential pressure at a point where the airstream flows in a direction

1—not parallel to the true angle of attack of the aircraft.
2—parallel to the angle of attack of the aircraft.
3—parallel to the angle of incidence.
4—parallel to the longitudinal axis of the aircraft.

**8645.** Turboprop engine temperatures are measured by

1—iron/constantan thermocouples.
2—electrical resistance thermometers.
3—chromel/alumel thermocouples.
4—ratiometer electrical resistance thermometers.

**8646.** Which provides manual maneuverability of the aircraft while the autopilot is engaged?

1—Servo-amplifier.
2—Attitude indicator.
3—Directional gyro indicator.
4—Flight controller.

**8647.** What component of an autopilot system applies torque to the control surfaces?

1—Servo.
2—Controller.
3—Gyros.
4—Computer.

**8648.** If a transport category turboprop airplane has a takeoff weight of 105 percent of the maximum landing weight, what system is required to be installed?

1—Fuel jettison.
2—Fuel injections.
3—Crossfeed bypass.
4—Fuel transfer.

**8649.** When required, how is excess fuel jettisoned?

1—Through a common manifold and outlet in each wing.
2—By gravity flow into the outboard wing tanks and overboard through a common outlet in each wing.
3—By pump pressure into the crossfeed manifold and overboard through the vent lines.
4—Through individual outlets in each tank.

**8650.** A fuel jettisoning system consists of

1—filters, switches, valves, dump chutes, and chute operating mechanisms.
2—lines, valves, dump chutes, and chute operating mechanisms.
3—tanks, filters, valves, lines, dump chutes, and chute operating mechanisms.
4—flowmeters, filters, valves, lines, dump chutes, and chute operating mechanisms.

**8651.** When defueling an airplane of sweptwing configuration, which procedure should be followed?

1—Defuel all the tanks at one time.
2—Defuel the fuselage tanks last.
3—Transfer fuel to the inboard tanks, then defuel them first.
4—Defuel the outboard wing tanks first.

**8652.** Before fueling an aircraft by using the pressure fueling method, what important precaution should be observed?

1—Truck pump pressure must be correct for that refueling system.
2—Truck pump pressure must be adjusted for minimum filter pressure.
3—The hose must be connected before grounding.
4—The aircraft's electrical system must be on to indicate quantity gauge readings.

**8653.** What flight safety related advantage does a pressure fueling system provide?

1—Eliminates aircraft skin damage from hoses and nozzles.
2—Increases the chances of static electricity igniting fuel vapors.
3—Reduces the chances for fuel contamination.
4—Reduces the time required for fueling.

**8654.** Where are instructions for pressure fueling a turboprop airplane normally placarded?

1—On the flightcrew checklist.
2—Located on the fuel control panel access door.
3—On the lower wing surface adjacent to the access door.
4—On the ground crew checklist.

**8655.** (Refer to figure 57.) What is the maximum payload under operating conditions No. 1.

1—21,500 pounds.
2—25,200 pounds.
3—27,375 pounds.
4—30,200 pounds.

**8656.** (Refer to figure 57.) Determine the maximum payload under operating conditions No. 2.

1—28,600 pounds.
2—26,100 pounds.
3—25,500 pounds.
4—24,200 pounds.

**8657.** (Refer to figure 57.) Compute the maximum payload under operating conditions No. 3.

1—19,650 pounds.
2—20,500 pounds.
3—28,550 pounds.
4—29,450 pounds.

**8658.** Entrained water in aviation turbine fuel is a hazard because of its susceptibility to freezing as it passes through the filters. Which is a common method of preventing this hazard?

1—Adding deicing fluid to the fuel.
2—Use of micromesh fuel strainers.
3—Application of high-velocity fuel pumps.
4—Use of anti-icing fuel additives.

**8659.** Why are jet fuels more susceptible to water contamination than aviation gasoline?

1—Jet fuel has a higher viscosity than gasoline.
2—Condensation is greater because of the rapid burn-off of jet fuels.
3—Jet fuel is lighter than gasoline; therefore, water is more easily suspended.
4—Processing and handling of jet fuel is less stringent than gasoline.

**8660.** What is measured with a drip gauge?

1—The amount of fuel in a tank.
2—Any fuel selector valve leakage.
3—Any system leakage when the system is shut down.
4—Fuel pump diaphragm leakage.

**8661.** What is the function of a fuel totalizer?

1—Measures the amount of fuel being delivered to each engine.
2—Shows the amount of fuel in any given tank.
3—Indicates the total rate at which all engines are consuming fuel.
4—Indicates the amount of fuel in all the fuel tanks.

**8662.** Which is a means of controlling the fuel temperature on turbine powered aircraft?

1—Electric heating unit at the fuel filter.
2—Use of engine lubricating oil at the fuel filter.
3—Directing engine bleed air around the fuel tank.
4—Directing engine bleed air to a heat exchanger.

**8663.** On turbine powered airplanes, what method is used to determine if conditions are conducive to formation of ice crystals in the fuel?

1—Fuel pressure warning system.
2—Fuel pressure gauge indications.
3—Fuel strainer pressure gauge fluctuations.
4—Fuel temperature indications.

**8664.** Which would give the first positive indication that a change-over from one fuel tank to another is needed?

1—Fuel pressure warning.
2—Fuel pressure gauge.
3—Fuel flowmeter.
4—Fuel quantity indicator.

**8665.** A fuel temperature indicator is located in the fuel tanks on some turbine-powered airplanes to tell when the fuel may be

1—getting cold enough to form hard ice.
2—in danger of forming ice crystals.
3—getting too cold to vaporize and burn.
4—about to form rime ice.

**8666.** During ground operation of a turbopropeller airplane, how is a starter-generator cooled?

1—Ram air.
2—Engine bleed air.
3—An integral fan.
4—The environmental system cooling air.

**8667.** During flight operations, how is the starter-generator of a turboprop aircraft cooled?

1—The environmental system cooling air.
2—An integral booster fan combined with ram air.
3—Engine bleed air.
4—An external motor-driven fan.

**8668.** What is the function of a rectifier?

1—Changes direct current into alternating current.
2—Steps up voltage in multiples of two.
3—Changes alternating current into direct current.
4—Reduces voltage in multiples of two.

**8669.** (Refer to figure 58.) What minimum weight of cargo must be moved from the aft to the forward cargo location to bring the CG within limits of operating conditions No. 1?

1—20 pounds.
2—117 pounds.
3—195 pounds.
4—2,200 pounds.

**8670.** (Refer to figure 58.) Determine the minimum weight to be shifted from the aft to the forward cargo compartment to bring the CG within limits of operating conditions No. 2.

1—50 pounds.
2—455 pounds.
3—610 pounds.
4—5,115 pounds.

**8671.** (Refer to figure 58). Determine the minimum weight required to be shifted from the forward to the aft cargo location to bring the CG within the limits specified under operating conditions No. 3.

1—50 pounds.
2—250 pounds.
3—410 pounds.
4—1,750 pounds.

**8672.** Aircraft fuse capacities are rated in

1—volts.
2—ohms.
3—amperes.
4—watts.

**8673.** In aircraft electrical systems, automatic reset circuit breakers

1—are not used as circuit protective devices.
2—are found in locations where only temporary overloads are normally encountered.
3—are not accessible to crewmembers in flight.
4—must be used in all circuits essential to safe operation of the aircraft.

**8674.** Which is an important factor in selecting aircraft fuses?

1—Be sure the current exceeds a predetermined value.
2—The voltage rating should be lower than the maximum circuit voltage.
3—That the inner strip of metal is made of an alloy of tin and bismuth.
4—Capacity matches the needs of the circuit.

**8675.** The circuit breaker in the instrument panel lighting system protects the

1—lights from too much current.
2—wiring from too much current.
3—wiring from too much voltage.
4—lights from too much wattage.

**8676.** Which of the following is considered to be an intermittent duty circuit?

1—Anticollision light circuit.
2—Landing light circuit.
3—Instrument panel light circuit.
4—Navigation light circuit.

**8677.** Which starter provides the best power-to-weight ratio?

1—Electrical starter.
2—Starter-generator.
3—Air turbine starter.
4—Pawl and ratchet starter.

**8678.** As applies to an electrical system, what is a relay?

1—A magnetically operated switch.
2—A device used to increase, or step up voltage.
3—An electrical energy converter, changing electrical energy into heat energy.
4—Any conductor which receives electrical energy and passes it on with little or no resistance.

**8679.** Aircraft generators are rated in

1—watts at rated voltage.
2—ohms at rated voltage.
3—amperes at rated voltage.
4—voltage at rated amperes.

**8680.** What unit of power is used in d.c. electrical circuits?

1—Amperes.
2—Volts.
3—Joules.
4—Watts.

**8681.** On large turbine aircraft wing flap systems, why are electrical transmitting position indicators used instead of the mechanical type?

1—Greater reliability of the electrical type.
2—They are more accurate.
3—Require less maintenance and cheaper to build.
4—They weigh less.

**8682.** What is the purpose of skid detectors?

1—Reduce brake drag.
2—Aid in effective braking.
3—Reduce hydraulic pressure in the system.
4—Indicate when the tires are skidding.

**8683.** An antiskid system is primarily

1—a hydraulic system.
2—an electro-hydraulic system.
3—an electrical system.
4—a mechanical linkage system.

**8684.** In most installations, how is the antiskid brake system activated or armed?

1—A switch in the cockpit.
2—By hydraulic pressure.
3—An electrical impulse.
4—Centrifugal forces acting upon the wheels.

**8685.** Which of the following conditions would most likely cause the landing gear warning signal to sound?

1—Landing gear not locked down and throttle advanced.
2—Landing gear locked down and throttle advanced.
3—Throttle retarded, landing gear locked down.
4—Throttle retarded, landing gear not locked down.

**8686.** What safety device is actuated by the compression and extension of a landing gear strut?

1—Ground lock pins.
2—Uplock switch.
3—Downlock switch.
4—Ground safety switch.

**8687.** Landing gear warning systems usually provide which of the following indications?

1—Red light for unsafe gear, no light for gear down, and green light for gear up.
2—Green light for gear up and down, red light for unsafe gear.
3—A position indicator gauge plus green light for gear up, and no light for gear down.
4—Red light for unsafe gear, green light for gear down, and no light for gear up.

**8688.** Which landing gear warning devices are incorporated on all retractable landing gear aircraft?

1—Visual indicator showing gear position.
2—A light which comes on when the gear is fully down and locked.
3—A light which comes on when the gear is fully up and locked.
4—A horn, or other aural device and a red warning light.

**8689.** When a landing gear safety switch on a main gear strut closes at liftoff, which system will be deactivated?

1—Landing gear position indicators.
2—Antiskid system.
3—Pressurization system.
4—Aural warning system.

**8690.** Some aircraft are protected against airframe icing by heating the leading edges of the airfoils. When is this type of anti-ice system usually operated during flight?

1—Continuously while the aircraft is in flight.
2—In symmetrical cycles during icing conditions to remove ice as it accumulates.
3—At all times while the outside air temperature is below freezing.
4—Whenever icing conditions are first encountered or expected to occur.

**8691.** Name two possible sources of hot air for operation of a wing thermal anti-icing system?

1—Turbo-compressors and hot air storage tank.
2—Engine bleed air and vacuum pump.
3—Engine bleed air and combustion heaters.
4—Augmenter tubes and exhaust gases.

**8692.** What is the principle of a windshield pneumatic rain removal system?

1—An air blast spreads a liquid rain repellant evenly over the windshield and that prevents raindrops from clinging to the glass surface.
2—A liquid repellant is sprayed onto the windshield and uses the raindrops as a carrying agent to carry away the rain, keeping the glass surface clear.
3—An air blast forms a barrier that prevents raindrops from striking the windshield surface.
4—A pneumatic rain removal system is simply a mechanical windshield wiper system that is powered by pneumatic system pressure.

**8693.** What occurs when a visual smoke detector is activated?

1—A warning bell within the indicator alarms automatically.
2—A lamp within the indicator illuminates automatically.
3—A lamp within the indicator extinguishes automatically.
4—The test lamp illuminates and an alarm is provided automatically.

**8694.** Smoke detectors which use a measurement of light transmissibility in the air are called

1—electromechanical devices.
2—photoelectrical devices.
3—visual devices.
4—electromeasuring devices.

**8695.** Which of the following fire-detection systems measure temperature rise compared to a reference temperature?

1—Fenway continuous loop.
2—Thermal switch.
3—Lindberg continuous element.
4—Thermocouple.

**8696.** Smoke in the cargo and/or baggage compartment of an aircraft is commonly detected by which of the following instruments?

1—Visual scanner.
2—Chemical reactor.
3—Photoelectric cell.
4—Sniffer.

**8697.** With reference to the operation of a photoelectric smoke detector, which is correct?

1—A photoelectric smoke detector measures the amount of smoke under a specific set of conditions.
2—A photoelectric smoke detector measures the amount of light available under a specific set of conditions.
3—Photoelectric smoke detectors will warn only when smoke is present.
4—Photoelectric smoke detectors are not affected by dust, soot, or other contaminants because it senses the difference between these and smoke.

**8698.** How does the thermocouple in a fire-detection system cause the warning system to operate?

1—It generates a small current when heated.
2—Heat decreases its electrical resistance.
3—It expands when heated and forms a ground for the warning system.
4—Heat increases its electrical resistance.

**8699.** How is the thermocouple fire-warning system activated?

1—By a slowly overheating engine.
2—Upon reaching a certain temperature.
3—A core resistance drop.
4—By a rate of temperature rise.

**8700.** What are built-in aircraft fire-extinguishing systems ordinarily charged with?

1—Carbon monoxide and nitrogen.
2—Freon and nitrogen.
3—Carbon tetrachloride.
4—Sodium bicarbonate.

**8701.** What happens when the emergency shutoff valves are closed during an engine fire?

1—Fuel flow to the engine will be blocked.
2—Fire-warning systems will be deactivated.
3—Fire-extinguishers will automatically discharge.
4—The fire-detection system will be deactivated.

**8702.** What method is used to detect the thermal discharge of a built-in carbon dioxide fire-extinguisher system?

1—Discolorization of the yellow plastic disc in the thermal discharge line.
2—Rupture of the red plastic disc in the thermal discharge line.
3—Thermal plug missing from the side of the bottle.
4—Rupture of the green plastic disc in the thermal discharge line.

**8703.** Which type of fire-detection system would also signal an overheat condition?

1—Thermocouple system.
2—Continuous loop system.
3—Pressure-sensitive unit.
4—Thermographic sensor system.

**8704.** In some fire-extinguishing systems, evidence that the system has been intentionally discharged is indicated by the absence of a

1—blue disc on the side of the fuselage.
2—red disc on the side of the fuselage.
3—green disc on the side of the fuselage.
4—yellow disc on the side of the fuselage.

**8705.** What is the principle advantage of using propeller reduction gears?

1—Enable the propeller RPM to be increased without an accompanying increase in engine RPM.
2—Allows diameter and blade area to be increased.
3—Enable the engine RPM to be increased with an accompanying increase in power while allowing the propeller to remain at a lower, and more efficient RPM.
4—Enable the engine RPM to be increased with an accompanying increase in propeller RPM.

**8706.** In an axial-flow turbine engine, at what point will the highest gas pressures occur?

1—Immediately after the turbine section.
2—At the turbine entrance.
3—Within the burner section.
4—At the compressor outlet.

**8707.** Identify a function of the nozzle diaphragm in a turbine engine?

1—Decrease the velocity of exhaust gases.
2—Center the fuel spray in the combustion chamber.
3—Direct the flow of gases to strike the turbine buckets at a desired angle.
4—Direct the flow of gases into the combustion chamber.

**8708.** What is the profile of a turbine engine compressor blade?

1—The shape of the blade root at the disc attachment.
2—The leading edge of the blade.
3—A cutout that reduces blade tip thickness.
4—The curvature of the blade root.

**8709.** Using turbine engine terminology, what does the abbreviation "P" with subscript "t7" (Pt7) mean?

1—Total inlet pressure.
2—Pressure and temperature at station No. 7.
3—Seven times the temperature divided by the total pressure.
4—Total pressure at station No. 7.

**8710.** What is the function of the nozzle diaphragm located on the upstream side of the turbine wheel?

1—Increase the pressure of the exhaust mass.
2—Increase the velocity of the heated gases flowing past the nozzle diaphragm.
3—Direct the flow of gases parallel to the chord line of the turbine buckets.
4—Decrease the velocity of the heated gases flowing past the nozzle diaphragm.

**8711.** Which section of a turbine engine provides for proper mixing of the fuel and air?

1—Combustion section.
2—Compressor section.
3—Turbine section.
4—Accessory section.

**8712.** In a gas turbine engine, combustion occurs at a constant

1—volume.
2—pressure.
3—velocity.
4—density.

**8713.** Regarding turboprop engines, which statement is correct?

1—At the lower engine speeds, power output increases rapidly with small increases in RPM.
2—At the higher engine speeds, power output increases rapidly with small increases in RPM.
3—Turboprop engines operate less efficiently at the higher altitudes due to the lower temperatures encountered.
4—The power delivered per pound of air consumed is less at low altitude than at high altitude.

**8714.** Some high-volume turbine engines are equipped with two-spool or split compressors. When operated at high altitudes, the

1—throttle must be retarded to prevent overspeed of the two compressor rotors due to the lower density air.
2—low-pressure rotor will increase in speed as the compressor load decreases in the lower density air.
3—throttle must be retarded to prevent overspeed of the high-pressure rotor due to the lower density air.
4—low-pressure rotor will decrease in speed as the compressor load decreases in the lower density air.

**8715.** Turbine engines use a nozzle diaphragm which is located on the upstream side of the turbine wheel. One of the functions of this unit is to

1—decrease the velocity of the heated gases flowing past this point.
2—direct the flow of gases parallel to the vertical line of the turbine buckets.
3—increase the velocity of the heated gases flowing past this point.
4—increase the pressure of the exhaust mass.

**8716.** In a turboprop engine, what is the location of the highest gas pressure?

1—At the outlet of the tailpipe section.
2—At the entrance of the turbine section.
3—In the entrance of the burner section.
4—In the outlet of the burner section.

**8717.** What is the function of the stator vane assembly at the discharge end of a typical axial-flow compressor?

1—Reduce drag on the first stage turbine blades.
2—Straighten airflow to eliminate turbulence.
3—Direct the flow of gases into the combustion chambers.
4—Increase air swirling motion into the combustion chambers.

**8718.** The turbines located near the rear of a turboprop engine

1—compress air heated in the combustion section.
2—increase air velocity for propulsion.
3—circulate air to cool the engine.
4—drive the compressor section.

**8719.** When starting a turboprop engine

1—a hot start is indicated if the exhaust gas temperature exceeds specified limits.
2—an excessively lean mixture is likely to cause a hot start.
3—the engine should start within 60 to 80 seconds after the fuel condition lever is opened.
4—release the starter switch as soon as an indication of light-off occurs.

**8720.** In the dual axial-flow, or twin spool compressor system, what is driven by the first stage turbine?

1—$N_1$ and $N_2$ compressors.
2—$N_4$ compressor.
3—$N_2$ compressor only.
4—$N_1$ compressor only.

**8721.** When starting a turboprop engine, what indicates a hung start?

1—Exhaust gas temperature exceeds specified limits.
2—The engine fails to reach idle RPM.
3—RPM exceeds specified operating limits.
4—EPR fails to reach minimum operating limits.

**8722.** Generally speaking, what are the two main sections of a turboprop engine?

1—Combustion and exhaust.
2—Hot and cold.
3—Compressor and turbine.
4—Turbine and propeller reduction.

**8723.** What are the two basic elements of the turbine section of a turbine engine?

1—Impeller and diffuser.
2—Compressor and manifold.
3—Bucket and expander.
4—Rotor and stator.

**8724.** What are the two functional elements of a centrifugal compressor?

1—Turbine and compressor.
2—Compressor and manifold.
3—Bucket and expander.
4—Impeller and diffuser.

**8725.** Which is the most satisfactory method of attaching turbine blades to turbine wheels?

1—The fir-tree design.
2—The tongue and groove design.
3—High temp/high strength adhesive method.
4—Press fit method.

**8726.** Which compressor contains vanes on both sides of the impeller?

1—Single entry centrifugal compressor.
2—Double entry centrifugal compressor.
3—Double entry axial-flow compressor.
4—Single entry axial-flow compressor.

**8727.** What is the first engine instrument indication of a successful start of a turboprop engine?

1—Propeller RPM stabilized.
2—Rise in the engine fuel flow.
3—Decrease in the engine pressure ratio.
4—Rise in the exhaust gas temperature.

**8728.** How does a dual axial-flow compressor improve the efficiency of a turbine engine?

1—More turbine wheels can be used.
2—Combustion chamber temperatures are reduced.
3—Higher compression ratios can be obtained.
4—The velocity of the air entering the combustion chamber is increased.

**8729.** Name two basic types of turbine blades.

1—Reaction and converging.
2—Tangential and reaction.
3—Reaction and impulse.
4—Impulse and fir tree.

**8730.** Which is correct for a turboprop powerplant propeller installation?

1—The propeller is governed at the same speed as the turbine.
2—Speed of the engine is controlled by the propeller when in the beta range.
3—The propeller accounts for 75 to 85 percent of the total thrust output.
4—The propeller accounts for 15 to 25 percent of the total thrust output.

**8731.** Which is an advantage of the axial flow compressor?

1—Low starting power requirements.
2—Low weight.
3—High peak performance.
4—High frontal area.

**8732.** What is the purpose of the stator blades in the compressor section of a turbine engine?

1—Stabilize pressure.
2—Prevent compressor surge.
3—Control direction of the airflow.
4—Increase velocity of the airflow.

**8733.** What is the purpose of the diffuser section in a turbine engine?

1—Increase pressure and reduce velocity.
2—Speed up the airflow in the turbine section.
3—Convert pressure to velocity.
4—Reduce pressure and increase velocity.

**8734.** Where is the diffuser section located in a turbine engine?

1—Between the burner section and the turbine section.
2—Between the $N_1$ section and the $N_2$ section.
3—Directly in front of station No. 7.
4—Aft of the compressor section and forward of the burner section.

**8735.** Which is the most common method of reversing thrust on turboprop equipped aircraft?

1—Use of convergent and divergent ducts.
2—Clamshell reversers.
3—Reversed propeller thrust.
4—Mechanical blockage and aerodynamic blockage systems.

**8736.** Why is damage to turbine vanes likely to be much greater than damage to compressor vanes?

1—Turbine vanes are subject to much greater stress in the combustor.
2—Turbine vanes suffer much more from heat stress.
3—Thrust clearance is much greater in turbine vanes.
4—Vibration and other stresses are more severe.

**8737.** Which is the ultimate limiting factor in turbine engine operating limitations?

1—Compressor and inlet air temperature.
2—Compressor outlet air temperature.
3—Turbine inlet temperature.
4—Burner-can pressure.

**8738.** If a flight engineer completes a required annual flight check in December 1988 and the required annual recurrent flight check in January 1990, the latter check is considered to have been taken in

1—December.
2—January.
3—February.
4—November.

**8739.** Which engine variable is the most critical during turbine engine operation?

1—Compressor inlet air temperature.
2—Compressor RPM.
3—Exhaust pressure ratio.
4—Turbine inlet temperature.

**8740.** Reduced blade vibration and improved airflow characteristics in gas turbines are brought about by

1—fir tree blade attachment.
2—impulse type blades.
3—shrouded turbine rotor blades.
4—bulb root attachment.

**8741.** Which compressors offer the greatest advantages in starting flexibility and improved high-altitude performance?

1—Single-stage, centrifugal-flow.
2—Dual-stage, centrifugal-flow.
3—Split-spool, axial-flow.
4—Single-spool, axial-flow.

**8742.** Which is an advantage of the centrifugal-flow compressor?

1—High frontal area.
2—High pressure rise per stage.
3—Increased ram efficiency.
4—Increased peak efficiency.

**8743.** In a turboprop engine, where is the highest heat-to-metal contact located?

1—In the burner cans.
2—At the exhaust cone.
3—At the turbine inlet guide vanes.
4—On the turbine blades.

**8744.** Which two elements make up the axial-flow compressor assembly?

1—Rotor and stator.
2—Rotor and diffuser.
3—Compressor and burner.
4—Stator and diffuser.

**8745.** What are the two types of centrifugal compressor impellers?

1—Single stage and two stage.
2—Single entry and double entry.
3—Rotor and stator.
4—Impeller and diffuser.

**8746.** What name is applied to the row of stationary blades located between each row of rotating blades in a turbine engine compressor?

1—Buckets.
2—Expanders.
3—Diffuser blades.
4—Stators.

**8747.** If aircraft turbine blades are subjected to excessive temperatures, what type of failures would be expected?

1—Compression and torsional.
2—Bending and torsional.
3—Torsional and tension.
4—Stress rupture.

**8748.** In an axial-flow compressor, one purpose of the stator vanes at the discharge end of the compressor is to

1—prevent compressor surge and eliminate stalls.
2—straighten the airflow and eliminate turbulence.
3—increase the velocity and prevent swirling and eddying.
4—decrease the velocity, prevent swirling, and decrease pressure.

**8749.** Dirty compressor blades may result in

1—low RPM.
2—low EGT.
3—high RPM.
4—high EGT.

**8750.** Name the two types of compressors most commonly used in turbine engines?

1—Axial and root.
2—Centrifugal and reciprocating.
3—Root and centrifugal.
4—Centrifugal and axial.

**8751.** On an axial-flow engine, what is the purpose of shrouds on the turbine blades?

1—Reduce vibration.
2—Shorten run-in time.
3—Increase tip speed.
4—Reduce icing probability.

**8752.** In a dual axial-flow compressor, the first stage turbine drives

1—$N_2$ compressor.
2—$N_1$ compressor.
3—Low pressure compressor.
4—Both low and high pressure compressors driven on a common shaft.

**8753.** If a turbine engine catches fire during the start cycle, what should be done?

1—Turn off the fuel and continue cranking.
2—Disengage starter immediately and exit the aircraft.
3—Continue starting in an attempt to blow out the fire.
4—Place power lever in the increase position to increase the exhaust pressure and expel fuel fumes.

**8754.** What is the proper start sequence for a turbine engine?

1—Ignition, starter, then fuel.
2—Fuel, starter, then ignition.
3—Starter, ignition, then fuel.
4—Starter, fuel, then ignition.

**8755.** If a turbine engine experiences an inflight flameout, this is usually caused by

1—high exhaust gas temperature.
2—interruption of the inlet airflow.
3—fouling of the primary igniter plugs.
4—clogged fuel nozzles.

**8756.** Which units in a turbine engine aid in stabilization of the compressor during low thrust engine operations?

1—Bleed air valves.
2—Stator vanes.
3—Inlet guide vanes.
4—Pressurization and dump valves.

**8757.** In a turbine engine with a dual axial-flow compressor, the low speed compressor

1—always turns at the same speed as the high speed compressor.
2—is connected directly to the high speed compressor.
3– seeks its own best operating speed.
4—has a higher compressor shaft speed than the high speed compressor.

**8758.** What is the function of the inlet guide vane assembly on a centrifugal compressor?

1—Directs the air into the first stage rotor blades at the proper angle.
2—Converts velocity energy into pressure energy.
3—Converts pressure energy into velocity energy.
4—Picks up air and adds energy as it accelerates outward due to centrifugal force.

**8759.** The stator vanes in an axial-flow compressor

1—convert velocity energy into pressure energy.
2—convert pressure energy into velocity energy.
3—direct air into the first stage rotor vanes at the proper angle.
4—pick up air and add energy as it accelerates outward by centrifugal force.

**8760.** When starting a turbine engine, when should the starter be disengaged?

1—Immediately after engine light-off.
2—When the engine reaches idle RPM.
3—When the RPM indicator shows 100 percent.
4—Upon activation of the ignition and fuel systems.

**8761.** What is the primary advantage of an axial-flow compressor over a centrifugal compressor?

1—Easier maintenance.
2—High frontal area.
3—Less expensive.
4—Greater pressure ratio.

**8762.** What is the purpose of blow-in doors in the induction system of a turbine engine?

1—Admit air to the engine compartment during ground operation when the engine air requirements are in excess of the amount the normal intake system can supply.
2—Fire extinguisher openings.
3—Admit air to the engine compartment during !light when the aircraft attitude is not conducive for ram air affect.
4—Access openings for inspection of compressor and turbine blades.

**8763.** What is a double entry centrifugal compressor?

1—A compressor has two intakes.
2—A two stage compressor independently connected to the main shaft.
3—Two compressors and two impellers.
4—A compressor with vanes on both sides of the impeller.

**8764.** What is the major function of the turbine assembly in a turboprop engine?

1—Compress the air before it enters the combustion section.
2—Direct the gases in the proper direction to the tailpipe.
3—Supply power to turn the compressor.
4—Increase the temperature of the exhaust gases.

**8765.** What is the function of stator blades in the compressor section of an axial-flow turbine engine?

1—Increase the air velocity and prevent swirling.
2—Straighten the airflow and accelerate it.
3—Decrease the air velocity and prevent swirling.
4—Prevent compressor surges.

**8766.** What comprises the three main sections of a turbine engine?

1—Compressor, diffuser, and scavenge.
2—Turbine, combustion, and scavenge.
3—Combustion, compressor, and inlet guide vane.
4—Compressor, combustion, and turbine.

**8767.** What type turbine blade is most commonly used in aircraft turbine engines?

1—Reaction.
2—Divergent.
3—Impulse.
4—Reaction-impulse.

**8768.** What is the primary factor controlling the pressure ratio of an axial-flow compressor?

1—Number of stages in the compressor.
2—Rotor diameter.
3—Compressor inlet pressure.
4—Compressor inlet temperature.

**8769.** What are the main sections of a turboprop engine?

1—Fan, combustion, and exhaust.
2—Compressor, combustion, and diffuser.
3—Compressor, combustion, and turbine.
4—Inlet, combustion, and turbine.

**8770.** A turbine engine hot section is particularly susceptible to which kind of damage?

1—Scoring.
2—Pitting.
3—Cracking.
4—Galling.

**8771.** Dirt particles in the air will, upon being introduced into the compressor of a turbine engine, form a coating on all but which parts?

1—Turbine blades.
2—Compressor blades.
3—Casings.
4—Inlet guide vanes.

**8772.** Severe rubbing of turbine engine compressor blades will usually cause

1—bowing.
2—cracking.
3—burning.
4—galling.

**8773.** A turbine engine having high exhaust gas temperature at desired engine pressure ratio on takeoff, indicates

1—that the engine is out of trim.
2—that the fuel controller should be replaced.
3—compressor bleed valve malfunction.
4—drain valve malfunction.

**8774.** The Brayton cycle is known as the constant

1—pressure cycle.
2—volume cycle.
3—temperature cycle.
4—mass cycle.

**8775.** Continued and/or excessive heat and centrifugal force on turbine engine compressor blades usually causes

1—profiling.
2—growth.
3—gouging.
4—galling.

**8776.** If the RPM of an axial-flow compressor remains constant, the angle of attack of the blades can be changed by

1—changing the velocity of the airflow.
2—changing the compressor diameter.
3—increasing the pressure ratio.
4—decreasing the pressure ratio.

**8777.** The compression ratio of an axial-flow compressor is a function of the

1—number of compressor stages.
2—rotor diameter.
3—diffuser area.
4—air inlet velocity.

**8778.** Which variable affects the inlet air density of a turboprop engine?

1—Turbine inlet temperature.
2—The speed of the aircraft.
3—Turbine and compressor efficiencies.
4—Compression ratio.

**8779.** Which factor affects the thermal efficiency of a turboprop engine?

1—Ambient temperature.
2—Speed of the aircraft.
3—Compression ratio.
4—Aircraft altitude.

**8780.** Why do some turbine engines have more than one turbine wheel attached to a single shaft?

1—Facilitate balancing of the turbine assembly.
2—Straighten the airflow before it enters the exhaust area.
3—Help stabilize the pressure between the compressor and the turbine.
4—Extract more power from the exhaust gases than a single wheel can absorb.

**8781.** Which types of combustion sections are found on turbine engines?

1—Variable, can-annular, and cascade vane.
2—Annular, variable, and cascade vane.
3—Can, multiple-can, and variable.
4—Multiple-can, annular, and can-annular.

**8782.** Why does a turboprop engine require a cool-down period before shutting it down?

1—To allow the surfaces contacted by the lubricating oil to return to normal operating temperatures.
2—Burn off excess fuel ahead of the fuel controller.
3—Allow the turbine wheel to cool before the case contracts around it.
4—To avoid seizure of the engine bearings.

**8783.** How many igniters are normally used on a turbine engine having nine burner cans?

1—One.
2—Two.
3—Three.
4—Nine.

**8784.** What is meant by a shrouded turbine?

1—The turbine blades are shaped so that their ends form a band or shroud.
2—Each turbine wheel is enclosed by a separate housing or shroud.
3—The turbine wheel is enclosed by a protective shroud to contain the blades in case of blade shank failure.
4—The turbine wheel has a shroud or duct which provides cooling air to the turbine blades.

**8785.** What term is used to describe a permanent and cumulative deformation of the turbine blades of an aircraft engine?

1—Stretch.
2—Elongation.
3—Distortion.
4—Creep.

**8786.** What is the purpose of the pressurization and dump valve used on turboprop engines?

1—Control the pressure of the compressor outlet by dumping air when pressure reaches an established level.
2—Allows fuel pressurization of the engine when starting and operating, and dumps fuel pressure at engine shutdown.
3—Control compressor stall by dumping compressor air under certain conditions.
4—Maintains fuel pressure to the fuel control valve and dumps excessive fuel back to the fuel tanks.

**8787.** At what stage in a turboprop engine are pressures the greatest?

1—Compressor inlet.
2—Turbine outlet.
3—Compressor outlet.
4—Exhaust pipe.

**8788.** Which instrument on a turboprop engine is used to determine engine power?

1—Turbine inlet temperature gauge.
2—Compressor RPM gauge.
3—Engine pressure ratio gauge.
4—Exhaust gas temperature gauge.

**8789.** How is engine pressure ratio determined?

1—Multiplying engine inlet total pressure by turbine outlet total pressure.
2—Multiplying turbine outlet total pressure by engine inlet total pressure.
3—dividing turbine outlet total pressure by engine inlet total pressure.
4—dividing engine inlet total pressure by turbine outlet total pressure.

**8790.** What instrument on a turboprop engine should be monitored to minimize the possibility of a "hot" start?

1—RPM indicator.
2—Turbine inlet temperature.
3—Horsepower meter.
4—Torquemeter.

**8791.** Engine pressure ratio is the total pressure ratio between the

1—front of the compressor and the rear of the compressor.
2—aft end of the compressor and the aft end of the turbine.
3—front of the compressor and the rear of the turbine.
4—front of the engine inlet and the aft end of the compressor.

**8792.** If a gas turbine engine has high exhaust gas temperature, high fuel flow, and low RPM at all engine power settings, what is indicated?

1—Insufficient electrical power to the instrument buss.
2—Fuel controller is malfunctioning.
3—Defective EGT and you should monitor other indicators.
4—Turbine damage or other loss of turbine efficiency.

**8793.** Gas turbine engine tachometers are usually

1—driven from the main engine shaft.
2—a direct indication of the accessory drive shaft RPM.
3—driven by the quill shaft which indicates RPM of the turbine.
4—calibrated in percent of RPM.

**8794.** What is the primary purpose of the tachometer on an axial-compressor turbine engine?

1—Monitor engine RPM during cruise conditions.
2—Principle instrument for establishing thrust settings.
3—Monitor engine RPM during starting and to indicate overspeed conditions.
4—Monitor power settings to avoid overtemp conditions.

**8795.** What does engine pressure ratio (EPR) indicate in a turbopropeller installation?

1—Engine thrust being produced.
2—Pressures within the turbine section.
3—Pressure ratio between the front and aft end of the compressor.
4—Ratio of engine RPM to compressor pressure.

**8796.** The exhaust gas temperature (EGT) indicator on a gas turbine engine provides a relative indication of the

1—exhaust temperature.
2—temperature of the $N_1$ compressor.
3—temperature of the exhaust gases as they pass the exhaust cone.
4—turbine inlet temperature.

**8797.** What instrument indicates the thrust of a gas turbine engine?

1—Torquemeter.
2—Exhaust gas temperature indicator.
3—Turbine inlet temperature indicator.
4—Engine pressure ratio indicator.

**8798.** In what units are turbine engine tachometers calibrated?

1—Percent of engine RPM.
2—Actual engine RPM as measured at the turbine.
3—Pounds per square inch.
4—Percent of engine pressure ratio.

**8799.** What is the function of a fire detection system when installed in a turboprop aircraft?

1—To discharge the powerplant extinguishing system at the origin of the fire.
2—Warn of the presence of fire in the rear section of the powerplant.
3—Activate a warning device in the event of a powerplant fire.
4—Identify the location of a powerplant fire.

**8800.** How are most turboprop engine fire-extinguishing systems activated?

1—Electrically discharged cartridges.
2—Manual remote control valve.
3—Piston stem and plunger.
4—Pushrod assembly attached to a red light.

**8801.** What is the purpose of a reverse-current cutout relay?

1—Eliminates the possibility of reversed polarity of the generator output current.
2—Prevents overloading the generator.
3—Prevents fluctuations of generator voltage.
4—Opens the main generator circuit whenever the generator voltage drops below the battery voltage.

**8802.** How is the automatic ignition relight switch activated on a gas turbine engine?

1—Sensing switch located in the tail section.
2—Decrease in exhaust temperatures.
3—Drop in the compressor-discharge pressure.
4—Drop in fuel flow.

**8803.** Which aircraft electrical circuit does not contain a fuse?

1—Generator circuit.
2—Air-conditioning circuit.
3—Exterior lighting circuit.
4—Starter circuit.

**8804.** What type of lubricating oil is used in turboprop engines?

1—Synthetic.
2—Petrolatum.
3—Vegetable base.
4—Molybdenum impregnated petroleum.

**8805.** What type oil system is usually found on turboprop engines?

1—Dry sump, pressure, and spray.
2—Wet sump, dip, and pressure.
3—Dry sump, dip, and splash.
4—Wet sump, spray, and splash.

**8806.** What type of oil pump is most commonly used on turboprop engines?

1—Gear.
2—Centrifugal.
3—Vane.
4—Diaphragm.

**8807.** What may be used to cool the oil in a turboprop engine?

1—Fuel and bleed air.
2—Ram air and bleed air.
3—Pressurization compressors and jet pumps.
4—Fuel and ram air.

**8808.** In a turboprop engine utilizing a fuel-oil heat exchanger, the oil temperature is controlled by a thermostatic valve that regulates the flow of

1—air past the heat exchanger.
2—fuel through the heat exchanger.
3—both fuel and oil through the heat exchanger.
4—oil through the heat exchanger.

**8809.** On engines equipped with axial-flow compressors, bleed air is sometimes used to aid in cooling the

1—oil.
2—inlet guide vanes.
3—oil cooler.
4—turbine.

**8810.** From which turbine engine components does oil extract the most heat?

1—Rotor coupling.
2—Compressor bearing.
3—Accessory drive bearing.
4—Turbine bearing.

**8811.** Which is a function of the fuel-oil heat exchanger on a turboprop engine?

1—Removes oil vapors.
2—Aerates the fuel.
3—Emulsifies the oil.
4—Increases fuel temperature.

**8812.** What markings must be on turbine engine oil tank filler openings?

1—The word "oil" and the type and grade specified by the manufacturer.
2—The word "oil" and the tank capacity.
3—Capacity of the tank and the grade of oil.
4—Type of oil approved for that engine.

**8813.** Why are oil coolers not used on turbine engines with wet-sump lubrication systems?

1—External oil tubes placed in selected areas about the engine are cooled by inlet air.
2—Cooling air is directed to the turbine wheel and bearings.
3—The oil tank serves as both a reservoir and cooler.
4—Synthetic oil runs cooler than mineral base oil, thus eliminating the need for additional cooling.

**8814.** If the oil system pressure relief valve should stick in the open position, what would be the probable result?

1—Increased oil pressure.
2—Decreased oil temperature.
3—Insufficient lubrication.
4—Pressurization of the case and increased oil leakage.

**8815.** What is the primary purpose of the oil-to-fuel heat exchanger?

1—Cool the fuel.
2—Cool the oil.
3—Reduce or prevent oil foaming.
4—Decrease oil viscosity.

**8816.** What is the purpose of directing bleed air to the bearings on turbine engines?

1—Increases the oil pressure for better lubrication.
2—Provides a high volume of oil to the most critical bearings.
3—Heats the oil to the proper operating temperature.
4—Eliminates the need for an oil cooler in a wet-sump lubrication system.

**8817.** As applies to the oil system of a turbine engine, which is correct?

1—During extreme cold weather operations, turbine engine oil must be diluted prior to start.
2—Dry-sump oil systems are most commonly used for turboprop operations.
3—Wet-sump oil systems are most commonly used on turbine engines.
4—For high altitude operations anti-icing additives must be put in the oil to prevent oil filters from becoming clogged with ice particles.

**8818.** A turbine engine dry-sump lubrication system of the self contained, high-pressure design

1—uses the same storage area as a wet-sump engine.
2—has no heat exchanger.
3—consists of pressure, breather, and scavenge subsystems.
4—stores oil in the engine crankcase.

**8819.** A component often found in turbine engine dry-sump lubrication systems, but not found in wet-sump systems is the

1—oil cooler.
2—reservoir.
3—pressure pump.
4—scavenge pump.

**8820.** The capacitor-type ignition system is used almost universally on turboprop engines because of its high voltage and

1—low amperage.
2—long life.
3—low-temperature range.
4—high-heat intensity.

**8821.** How does the ignition system of a turboprop engine differ from that of a reciprocating engine?

1—Magneto-to-engine timing is not critical.
2—One spark plug is used in each combustion chamber.
3—A high-voltage, high-energy spark is required for ignition.
4—Low-energy igniter plugs are used in place of spark plugs.

**8822.** Which identifies a radial engine?

1—O-540.
2—V-1710.
3—R-1830.
4—I-540.

**8823.** At low speeds, which powerplant will have the better economy?

1—Turbojet.
2—Pulsejet.
3—Fanjet.
4—Reciprocating engine.

**8824.** Nearly all high-powered reciprocating engines are equipped with a supercharger. How much of the rated horsepower may be required to drive the supercharger?

1—25 to 75 horsepower.
2—75 to 125 horsepower.
3—125 to 175 horsepower.
4—20 percent of the manufacturer's maximum rated horsepower.

**8825.** Which are balances used to reduce vibration in the crankshafts in reciprocating engines?

1—Fulcrum and pedestal.
2—Hydraulic and aerodynamic.
3—Dynamic and static.
4—Hydrostatic and aerodynamic.

**8826.** When a crankshaft is balanced where the forces created by crankshaft rotation and power impulses are balanced within themselves, this is known as

1—dynamic balance.
2—static balance.
3—hydrostatic balance.
4—aerodynamic balance.

**8827.** When the weight of the entire assembly of crankpins, crank checks, and counterweights are balanced around the axis of rotation, this is known as

1—dynamic balance.
2—static balance.
3—hydraulic balance.
4—hydrostatic balance.

**8828.** The majority of aircraft engine pistons are machined from

1—cast 4140 alloy tool steel.
2—chrome molybdenum steel.
3—forged aluminum alloy.
4—heat treated steel.

**8829.** How are radial engine cylinders numbered?

1—Clockwise as viewed from the accessory end.
2—Clockwise as viewed from the engine front.
3—Counterclockwise as viewed from the accessory end.
4—Randomly, according to each manufacturer.

**8830.** On double row radial engines, where are odd and even numbered cylinders located?

1—Even numbers in the rear row and odd numbers in the front row.
2—Odd numbers in the front row and even numbered cylinders in the rear row.
3—Odd numbers are every other cylinder starting with the top front row cylinder, others are even numbers.
4—Randomly, according to each manufacturer.

**8831.** It is general practice to provide reduction gearing for propellers on reciprocating engines with crankshaft speeds of at least

1—2,000 RPM.
2—2,500 RPM.
3—3,000 RPM.
4—3,500 RPM.

**8832.** Which defines the indicated horsepower of a modern reciprocating engine?

1—Computed horsepower based on engine RPM and manifold pressure adjusted to sea level.
2—The power developed in the combustion chambers without reference to friction losses within the engine.
3—The power developed in the engine as indicated by an indicated power development gauge on the control panel.
4—The power developed in the combustion chambers less computed friction losses within the engine.

**8833.** On modern reciprocating engines, what power losses may be expected through friction?

1—As high as 5 to 10 percent of the indicated horsepower.
2—As high as 5 to 10 percent of the brake horsepower.
3—As much as 10 to 15 percent of the indicated horsepower.
4—As much as 10 to 15 percent of the brake horsepower.

**8834.** Which type of horsepower determines the performance of the engine/propeller combination?

1—Indicated horsepower.
2—Brake horsepower.
3—Friction horsepower.
4—Thrust horsepower.

**8835.** If a large radial engine develops 1,800 brake horsepower, and is coupled with a hydraulic propeller of 85 percent efficiency, what is the thrust horsepower?

1—1,800.
2—1,530.
3—1,328.
4—850.

**8836.** On an engine rated at 1,250 thrust horsepower with a propeller capable of 82 percent efficiency, what is the brake horsepower?

1—1,800.
2—1,525.
3—1,475.
4—1,250.

**8837.** A radial engine of 1,830 cubic inch displacement is rated at 1,300 brake horsepower. If equipped with a propeller of 90 percent efficiency, what is the thrust horsepower?

1—1,444.
2—1,300.
3—1,170.
4—692.

**8838.** A propeller of 79 percent efficiency is coupled with an R-2800 reciprocating engine. If the resultant thrust horsepower is 1,580, what is the brake horsepower being developed?

1—1,580.
2—1,912.
3—2,000.
4—2,800.

**8839.** When will the mechanical efficiency of a reciprocating engine be the highest?

1—At cruise RPM since mechanical efficiency ratios determine the best cruise RPM.
2—During idle conditions since no loads are imposed.
3—When the engine is running at the RPM at which maximum brake horsepower is developed.
4—Only at high RPM and low manifold pressure settings.

**8840.** What is the mechanical efficiency rating of the average reciprocating aircraft engine?

1—98 percent.
2—90 percent.
3—85 percent.
4—80 percent.

**8841.** On reciprocating aircraft engines, how much of the heat of combustion is converted to useful power?

1—70-75 percent.
2—50-55 percent.
3—25-30 percent.
4—15-20 percent.

**8842.** Continual drifting of manifold pressure, without a corresponding movement of controls is known as

1—overboosting.
2—fibrillating.
3—overshoot.
4—bootstrapping.

**8843.** For use on large reciprocating engines, which is the most common engine starter?

1—Cartridge starter.
2—Electric inertia starter.
3—Combination inertia starter.
4—Direct-cranking electric starter.

**8844.** Which is the most correct engine cranking procedure as applied to large reciprocating engines?

1—After 2 minutes cranking, let the starter cool for 2 minutes, then repeat.
2—After 5 minutes cranking, let the starter cool down 5 minutes. After the second 5 minutes cranking, a cool down period of 30 minutes.
3—Crank the starter 1 minute, then cool for 1 minute. Repeat as necessary.
4—Crank the starter 1 minute, then cool for 1 minute. After the second 1 minute period, let cool for 5 minutes.

**8845.** Reciprocating engine torquemeters indicate the amount of torque pressure in

1—Pounds per square inch.
2—Foot pounds.
3—Inch pounds.
4—Inches of Mercury.

**8846.** What does the blue arc on the face of a torquemeter indicate?

1—Normal operating range.
2—Maximum continuous power range.
3—Permissible range for operation in auto-rich.
4—Permissible range for operation in auto-lean.

**8847.** What does the long red line marked on the face of a torquemeter represent?

1—Maximum torque pressure when using water injection.
2—Maximum torque pressure under all conditions.
3—Maximum torque pressure when water injection is not used.
4—Minimum torque pressure for all engine operations.

**8848.** On the manifold pressure gauge, the blue arc represents

1—the range in which the mixture control may be set to automatic-lean.
2—limits of operation with water injection.
3—the range in which the mixture control must be operated in the normal, or rich position.
4—the maximum manifold pressure allowed during takeoff.

**8849.** On manifold pressure gauges marked with two red lines, what is represented by the higher of the two?

1—Maximum continuous operation not to exceed 5 minutes.
2—Maximum recommended manifold pressure for normal takeoff.
3—Location at which the "pop-off" or safety valve will activate to protect the engine from overboost.
4—Maximum recommended manifold pressure for a "wet," or water injected takeoff.

**8850.** After start-up of a large radial engine, power should not be increased above warm-up RPM until oil temperatures have reached at least

1—40°F.
2—40°C.
3—20°F.
4—20°C.

**8851.** When a magneto check is performed, a drop in the torquemeter pressure indication is a good supplement to the variation in RPM. A loss in torquemeter pressure should not exceed

1—5 percent.
2—10 percent.
3—15 percent.
4—20 percent.

**8852.** When shutting down a large reciprocating engine, in which position should the intercooler shutters be placed?

1—There are no selections for intercooler shutters.
2—Fully closed position.
3—Half open position.
4—Full open position.

**8853.** On engines equipped with a two-speed supercharger, in what position should the supercharger control be placed when shutting the engine down?

1—Low blower.
2—High blower.
3—Off position.
4—Intercooler position.

**8854.** Oil cooler shutters should be placed in what position at engine shutdown?

1—Fully closed to retain oil temperature and prevent rapid cool down during cold weather.
2—Off position to allow normal function at start up.
3—Standby position in readiness for the next start up.
4—Full open to allow the oil temperature to return to normal.

**8855.** Which is most likely to cause immediate engine damage?

1—Afterfiring.
2—Pre-ignition (engine ping).
3—Backfiring.
4—Afterburning.

**8856.** In the event of in-flight failure of a turbocharged engine, identification of the failed engine may be difficult. Which instrument would be the most reliable indicator of engine failure?

1—Manifold pressure.
2—Tachometer.
3—Cylinder head temperature.
4—Torquemeter.

**8857.** In the event a propeller accidently goes into reverse pitch while in flight, what action should be taken?

1—Throttle moved to reverse idle, and the mixture to idle cutoff.
2—Throttle moved to forward idle, and feather the propeller.
3—Place the throttle in reverse idle, and feather the propeller.
4—Place the throttle in forward high power, trip the propeller reverse circuit breakers, and then feather the propeller.

**8858.** If a runaway propeller cannot be controlled by a reduction in power, what should be done?

1—Move the mixture to idle cutoff.
2—Switch to the alternate master engine.
3—Discharge one of the fire bottles into the engine.
4—Feather the propeller.

**8859.** Prior to takeoff, how can you determine if the propeller is in forward or reverse pitch?

1—Pull the feathering button. If the RPM decreases, the propeller is in reverse pitch.
2—Press the feathering button. If RPM increases, the propeller is in reverse pitch.
3—Press the propeller toggle switch forward. If the INC RPM indicator comes on, the propeller is in forward pitch.
4—Turn on the propeller electric deice. If there is no amperage draw, the propeller is in reverse pitch.

**8860.** While operating a four engine airplane, you notice the master engine and two others are turning 2,200 RPM, but the other engine is 100 RPM slower. How can you synchronize all engines?

1—Pressing the resynchronization button once if the master lever is in the manual position.
2—Holding down the resynchronization button until all engines are stabilized at the same RPM.
3—Pressing and releasing the resynchronization button at least twice.
4—Holding down the resynchronization button and adjusting the master lever.

**8861.** Which is an indication of oil congealed in the cooler core?

1—High oil temperature, low oil pressure.
2—High oil temperature, high oil pressure.
3—Low oil temperature, low oil pressure.
4—Low oil temperature, high oil pressure.

**8862.** During a wet takeoff the water supply becomes exhausted. What is the correct action?

1—Feather the propeller on the engine in question.
2—Mixture control to auto-rich and ADI switch off.
3—Reduce BMEP and turn ADI switch to off.
4—Mixture control to auto-rich, then reduce MAP and RPM.

**8863.** If reverse pitch is used too long on landing roll, which powerplant components are most likely to sustain damage?

1—Rear spark plugs.
2—Nose section thrust bearing.
3—Trailing edges of cowl flaps.
4—Ignition wiring.

**8864.** During a descent from altitude, when should the superchargers be shifted from high to low?

1—At the lowest altitude descent power can be obtained in high blower.
2—At the highest altitude descent power can be obtained in low blower.
3—Immediately prior to starting the descent.
4—At high blower critical altitude.

**8865.** During a descent, which procedure would provide the most protection against excessive master rod loads?

1—Establish and maintain a manifold pressure of not more than RPM/100.
2—Delay shifting to auto-rich until the aircraft arrives at final approach altitude.
3—Delay shifting to low blower until the aircraft arrives at the initial approach altitude.
4—Adjust throttles to maintain at least 1" Hg MAP for each 100 RPM.

**8866.** When shutting down a large radial engine, which is a recommended procedure?

1—Stop the engine only after cylinder head temperature is below 200°C.
2—Close the cowl flaps after the rotation stops.
3—If the engine backfires during the stopping attempt, place the ignition switch back on.
4—If the engine continues to run with the mixture in ICO, place the ignition switch off.

**8867.** When shifting from low blower to high blower at constant throttle settings, what normal indications will be observed?

1—A decrease in BMEP and a decrease in MAP.
2—An increase in BMEP and a decrease in MAP.
3—An increase in BMEP and an increase in MAP.
4—A decrease in BMEP and an increase in MAP.

**8868.** You are preparing for takeoff and have set maximum allowable takeoff BMEP and RPM. As the aircraft accelerates, the BMEP increases without movement of the throttle. What causes this BMEP change?

1—Increased ram effect.
2—Ground affect.
3—Improved propeller efficiency.
4—Propeller governor surging.

**8869.** Why should high blower not be used for takeoff from low altitude airports?

1—Detonation will occur at all power settings above maximum cruise power.
2—Engine overspeeding will result if takeoff MAP is obtained.
3—Excessive MAP will be needed to obtain takeoff BMEP.
4—Excessive BMEP will be developed at takeoff RPM and MAP.

**8870.** When running up engines during ground operations, why should the engines be operated at 1,000 RPM rather than idle speed?

1—Hydraulic pumps will not function properly at the low idle speeds.
2—This ensures that the generators are on line to the electrical system, rather than the battery.
3—Prevents engines from backfiring.
4—Prevents hydraulic locking of lower cylinders.

**8871.** When starting an engine equipped with a pressure carburetor, how should the primer be operated?

1—Mixture to idle cutoff, held on until engine start.
2—Used in accordance with outside air temperature while cranking, then turned off when engine starts.
3—Held on after the engine starts until the mixture is moved out of the idle cutoff position.
4—Used to an extent determined by the outside air temperature for a specified period after the engine has started.

**8872.** In the engine lubrication system, what is the function of the scavenge pump?

1—Pump oil from the engine, through the cooler, to the oil tank.
2—Provide an oil supply to the propeller feathering system.
3—Draw oil from the bottom of the tank to prevent engine driven pump cavitation.
4—Pump oil from the sump, through the hopper, to the oil cooler.

**8873.** When the engine water injection system is turned off, what will indicate proper operation?

1—An increase in water pressure.
2—A reduction in manifold pressure.
3—Illumination of the water pressure warning light.
4—An increase in fuel flow.

**8874.** When calculating limited brake horsepower, along with BMEP, what variable is used?

1—Manifold pressure.
2—Carburetor air temperature.
3—Propeller efficiency.
4—Crankshaft RPM.

**8875.** If a large reciprocating engine is operating with a cruise mixture setting that is 12 BMEP below the best power mixture setting, what effect will this have on cylinder head temperature?

1—Cylinder head temperature is relatively hot because the mixture burns too rapidly.
2—Cylinder head temperature is relatively hot because the mixture burns too slowly.
3—Excess fuel in the mixture will result in relatively cool cylinder head temperature.
4—Excess air in the mixture will result in relatively cool cylinder head temperature.

**8876.** In a climb from sea level to critical altitude with constant RPM and constant MAP, how will engine performance be affected?

1—Brake horsepower will gradually decrease.
2—Brake horsepower will gradually increase.
3—Throttle position will remain fixed.
4—Throttle position will gradually close.

**8877.** If fuel pressure drops to zero and a warning light becomes illuminated, but the engine continues to run smoothly, what action should be taken?

1—Engage the boost pumps to the high position.
2—Shut down the engine.
3—Operate the engine at reduced throttle settings.
4—Select a new fuel tank and watch for return of the fuel pressure.

**8878.** What is a function of standpipes in aircraft fuel tanks?

1—Prevent drawing water or sediment into the fuel pumps.
2—Retain a 45 minute fuel reserve in each tank.
3—Provide a separate fuel supply for the combustion heaters.
4—Retain a fuel reserve in main fuel tanks following fuel dump operations.

**8879.** The No. 3 generator is producing normal volts and zero amperes, while all other generators are producing normal volts and amperes. When No. 3 generator switch is turned off, the amperage output of the other generators increases. What is the probable trouble with the No. 3 generator?

1—Disconnected field circuit.
2—Reverse current relay is open.
3—Disconnect equalizing circuit.
4—Blown fuse in the ammeter circuit.

**8880.** On reciprocating engine powered airplanes, what is the function of a reverse current relay?

1—Prevent current flow from the generator to the bus.
2—Prevent current flow from the bus to the battery.
3—Prevent an operating generator from feeding current to an inoperative generator.
4—Prevent one generator from feeding excess current into a faulty circuit.

**8881.** Why are reciprocating engine generating systems paralleled?

1—To obtain equal generator voltages.
2—To obtain equal generator loads.
3—Adjust generator voltage, speed, and phase angle.
4—Connect all buses together when the generators have exactly the same (parallel) voltage output.

**8882.** To help vaporize the fuel, some radial engines route a bit of engine exhaust through the diffuser section just below the carburetor. What name is given to this area?

1—Swirler.
2—Expander.
3—Heat sink.
4—Hot spot.

**8883.** Engines to which sea level horsepower is boosted with an internal supercharger are called

1—turbocharged engines.
2—turbosupercharged engines.
3—ground-boosted engines.
4—aspirated engines.

**8884.** Large engines equipped with an oil-operated supercharger clutch have a low-gear ratio of about

1—eight to one.
2—seven to one.
3—six to one.
4—five to one.

**8885.** Large engines equipped with an oil-operated supercharger clutch have a high-gear ratio of about

1—twelve to one.
2—eleven to one.
3—ten to one.
4—nine to one.

**8886.** Large engines utilizing a blower which can be shifted from low to high are referred to as

1—ground boosted engines.
2—altitude engines.
3—maximum rated engines.
4—turbocharged engines.

**8887.** An engine to which a centrifugal air compressor is connected to the shaft of an exhaust gas-driven turbine to maintain manifold pressure is called

1—an altitude engine.
2—a ground boosted engine.
3—a turbosupercharged engine.
4—a maximum rated horsepower engine.

**8888.** The altitude at which the engine is at full throttle, and the waste gate of the turbocharger is fully closed to produce rated power, is known as the

1—critical altitude.
2—service ceiling.
3—absolute ceiling.
4—naturally aspirated ceiling.

**8889.** When large radial engines use gasoline for oil dilution, what happens to the gasoline after start up?

1—It remains diluted in the oil, necessitating a change of oil after two dilutions.
2—The fuel vapors enter the manifold from within and are burned with the regular fuel mixture.
3—When the oil warms up, the gasoline evaporates and leaves through the crankcase breather.
4—After shutdown, the gasoline settles to the bottom of the crankcase and is drained at the sump.

**8890.** When a large engine is equipped with a hydromatic propeller and dry sump oil tank, how is the propeller feathered if an engine oil line breaks, pumping all the engine oil overboard?

1—Hydromatic propellers are aerodynamic feathering.
2—The oil in the propeller hub is adequate for feathering.
3—The propeller does not operate on engine oil, instead has a separate system.
4—Through a special propeller feathering oil reserve in the oil tank.

**8891.** Which is the main limitation of straight mineral engine oil?

1—It cannot be mixed with any other oil.
2—Continuous usage is prohibited beyond the break-in period.
3—Tends to evaporate when temperatures are elevated.
4—Oxidizes at high temperatures, or when it is aerated.

**8892.** Additives used in ashless-dispersant oils cause

1—sludge forming materials to repel each other and stay suspended in the oil.
2—sludge forming materials to join together and then flow into the oil filter where they are trapped.
3—higher engine operating temperatures.
4—rapid break-down of the lubricating properties.

**8893.** Which is a disadvantage of synthetic engine lubricating oil?

1—More frequent oil changes.
2—Although less frequent oil changes, it has a reduced wear characteristic than ashless-dispersant oil.
3—Less capable of withstanding high engine operating temperatures.
4—Pronounced softening effect on rubber products and resins.

**8894.** Regarding the mixing of ashless-dispersant oils of different brands within the engine, which is correct?

1—Any oils meeting MIL-L-22851 specifications are physically compatible.
2—None of the ashless-dispersant oils of different brands are compatible with each other.
3—Only ashless-dispersant and synthetic oils may be mixed.
4—Ashless-dispersant oils are only compatible with straight mineral oil.

**8895.** There are no adverse side effects of mixing

1—any ashless-dispersant oils.
2—straight mineral oil of one brand with straight mineral, or ashless-dispersant oil of another brand.
3—ashless-dispersant oil with synthetic oil.
4—straight mineral oil with synthetic oil.

**8896.** Civilian aviation almost exclusively applies what viscosity designation to aviation oils?

1—Saybolt Seconds Universal Viscosity (SSU).
2—Society of Automotive Engineers (SAE).
3—Military Index Letters (MIL).
4—Alpha-numerical as designated by the manufacturer.

**8897.** Large radial engines carry their engine oil

1—by means of a wet sump lubrication system.
2—inside the crankcase and in the oil pan.
3—in self contained oil passages in the engine case.
4—outside the engine in a dry sump system.

**8898.** If a large radial engine is equipped with a dry sump lubrication system, where is engine oil routed after the scavenger pump?

1—Directly to the hopper tank.
2—To the oil filter, then to the hopper tank.
3—To the oil cooler, then back into the tank.
4—Pumped up to the upper cylinder valve train.

**8899.** When a large engine oil system is equipped with a compensated relief valve, normal operating pressure is maintained by the

1—oil cooler relief valve.
2—high-pressure spring.
3—low-pressure spring.
4—scavenger pump.

**8900.** In place of an oil dipstick, what may be used to determine oil tank levels?

1—Consumption rates as determined by flight logs.
2—Electro-sync pressure gauges.
3—Sensitive reading oil quantity gauges.
4—Clear sight gage.

**8901.** Concerning Bernoulli's principle, which is true?

1—The pressure of a fluid increases at the points where the velocity of the fluid increases.
2—The pressure of a fluid decreases at points where the velocity of the fluid increases.
3—Bernoulli's principle is not applicable to turbine engine operations.
4—Bernoulli's principle applies only to gases and not fluids.

**8902.** While starting a turbojet engine with a compressed air starter, a hung start occurs. Which would be the correct procedure?

1—Advance the power lever.
2—Increase the airpower to the starter.
3—Re-engage the starter.
4—Shut down the engine.

**8903.** When approaching the front of an idling turbojet engine, you should be aware that the hazardous area extends forward of the engine approximately

1—5 feet.
2—15 feet.
3—25 feet.
4—50 feet.

**8904.** During the start sequence of a turbojet engine, the turbine inlet temperature exceeds the specified maximum. Which action would be required?

1—Turn off the fuel and ignition, discontinue the start and initiate an investigation into the cause.
2—Advance the power lever and watch for excess smoke. If present, discontinue the start.
3—Continue the start since temperature will stabilize as soon as 10 percent RPM has been achieved.
4—Turn off the fuel and ignition, discontinue the start for 5 minutes, then initiate the start sequence.

**8905.** While starting a turbojet engine, you notice there is no oil pressure indication at 5,000 RPM. What action is required?

1—Turn off the ignition and fuel, discontinue the start, and have the oil pressure gauge inspected.
2—Turn off the ignition and fuel, let the engine motor for 5 minutes, and then initiate the start sequence.
3—Turn off the fuel and ignition, discontinue the start and investigate the cause.
4—Turn off the fuel and ignition, discontinue the start, wait 5 minutes, and initiate the start sequence.

**8906.** Mixing aviation gasoline with jet fuel will have what affect on turbojet engine efficiency?

1—No disadvantages.
2—Tetraethyl lead in the gasoline will be deposited on the turbine blades.
3—Tetraethyl lead in the gasoline will be deposited on the compressor blades.
4—Occasional mixing of aviation gasoline with jet fuel is beneficial in cleaning turbine engine blades.

**8907.** When comparing jet fuel to aviation gasoline with regard to susceptibility of contamination, which is correct?

1—Jet fuel is of higher viscosity, therefore, will not hold contaminants as well as gasoline.
2—Viscosity has no affect on contamination retention.
3—Both jet fuel and gasoline are equally susceptible to contamination.
4—Jet fuel is of a higher viscosity, therefore holds contaminants better.

**8908.** Which is an advantage of turbine fuel over gasoline?

1—Kerosene has a higher heat energy per unit of weight than gasoline.
2—Gasoline is a better lubricant than kerosene.
3—Gasoline has a higher heat energy per unit volume than kerosene.
4—Kerosene has a higher heat energy per unit volume than gasoline.

**8909.** Which best describes jet fuel identifier numbers?

1—Performance numbers to designate the volatility.
2—Numbers which are relative to the performance of the fuel inside the engine.
3—Type numbers and have no relation to the performance of the fuel inside the engine.
4—Type numbers used to designate the vaporization rate at specified atmospheric pressures.

**8910.** Which is the equivalent of 1 horsepower?

1—550 foot-pounds of work per minute.
2—2,000 foot-pounds of work per minute.
3—2,000 foot-pounds of work per second.
4—33,000 foot-pounds of work per minute.

**8911.** Which is not considered a method of heat transfer?

1—Convection.
2—Conduction.
3—Diffusion.
4—Radiation.

**8912.** Under which conditions will the rate of flow of a liquid through a metering device (or jet) be the greatest?

1—Unmetered pressure-18 PSI, metered pressure-17.5 PSI, atmospheric pressure-14.5 PSI.
2—Unmetered pressure-23 PSI, metered pressure-12 PSI, atmospheric pressure-14.3 PSI.
3—Unmetered pressure-17 PSI, metered pressure-5 PSI, atmospheric pressure-14.7 PSI.
4—Unmetered pressure-15 PSI, metered pressure-12 PSI, atmospheric pressure-14.7 PSI.

**8913.** A 120-pound force moves a 3,200 pound object horizontally a distance of 20 feet in 20 seconds. How much power was expended?

1—100 foot-pound per second.
2—120 foot-pound per second.
3—2,400 foot-pound per second.
4—3,200 foot-pound per second.

**8914.** If you double the container volume of a confined gas, (temperature remaining constant), pressure will

1—increase in direct proportion to the volume increase.
2—remain the same.
3—be doubled.
4—be reduced to one-half its original value.

**8915.** If you triple the pressure of a confined liquid, (temperature constant), how will this affect the volume?

1—The volume will be tripled.
2—Original volume will increase one-third.
3—Original volume will be reduced to one-third.
4—Volume will remain the same.

**8916.** With all other conditions constant, the pressure of an air mass is doubled. How will density be affected?

1—Density is doubled.
2—As the pressure increases, density varies inversely.
3—Density is decreased.
4—Density remains the same.

**8917.** The factors necessary to determine power consist of force exerted, distance the force moves, and

1—temperature of the power source.
2—pressure of the power source.
3—the angle resistance to the work.
4—time required to do the work.

**8918.** Concerning the concepts of heat and temperature, which is correct?

1—There is a direct relationship between temperature and heat.
2—There is an inverse variation between temperature and heat.
3—Temperature is a measure of intensity of heat.
4—Temperature is a measure of quality of heat.

**8919.** If both the volume and the absolute temperature of a confined gas are doubled, the pressure will

1—not change.
2—be doubled.
3—be halved.
4—become four times as great.

**8920.** Most large turbojet aircraft are equipped with a landing gear position warning system which will provide a warning in the cockpit when the throttle is

1—advanced when the gear is not down and locked.
2—retarded and gear is not down and locked.
3—advanced and gear is down and locked.
4—retarded and gear is down and locked.

**8921.** A flap position and warning system will sound an alarm in the cockpit of a turbojet airplane when the throttle is

1—advanced and flaps are positioned down.
2—retarded and flaps are positioned down.
3—advanced and flaps are not positioned for takeoff.
4—retarded and flaps are not positioned for takeoff.

**8922.** On turbojet engines, pressurization air, and the air utilized for air conditioning is tapped from the

1—exhaust section of the engine.
2—compressor section of the engine.
3—combustion section.
4—engine air inlet.

**8923.** During operation, which component of an air-cycle cooling system undergoes an air pressure and temperature drop?

1—Water separator.
2—Expansion turbine.
3—Primary heat exchanger.
4—Refrigeration bypass valve.

**8924.** In a freon vapor-cycle cooling system installed on turbojet airplanes, where is cooling air obtained for the condenser?

1—Turbine engine compressor.
2—Ambient air.
3—Subcooler air.
4—Pressurized cabin air.

**8925.** Turbine engine air typically used for air conditioning and pressurization is commonly referred to as

1—compressed air.
2—ram air.
3—conditioned air.
4—bleed air.

**8926.** When the cabin pressure regulator is operating in the differential mode, how is reference pressure vented to the atmosphere?

1—Through the dump valve.
2—By means of a relief valve.
3—Activation of an isobaric metering valve.
4—Through a differential metering valve.

**8927.** When the cabin pressure regulator is operating in the isobaric range, how is cabin pressure maintained constant?

1—Movement of the regulator bellows.
2—Limiting the flow of air to the cockpit.
3—The action of the cabin pressure safety valve.
4—Limiting the air from the reference chamber.

**8928.** The basic air-cycle cooling system consists of

1—a source of compressed air, heat exchangers, and a turbine.
2—heaters, coolers, and compressors.
3—ram air source, compressors, and engine bleeds.
4—heat exchangers and evaporators.

**8929.** On turbojet aircraft, what is the purpose of a dump valve?

1—Relieve all positive pressure from the cabin.
2—Establish a negative pressure differential.
3—Relieve the load on the compressors.
4—Prevent pressure in excess of the maximum differential.

**8930.** How is the cabin pressure of a pressurized aircraft usually controlled?

1—By a valve that stops the pressurization pump when a pressure equivalent to the maximum safe cabin altitude has been reached.
2—Use of a pressure-sensitive switch that causes the pressurization pump to turn on, or off as required.
3—By an automatic outflow valve that dumps all the pressure in excess of the amount for which it is set.
4—Use of a pressure-sensitive valve that controls the output pressure of the pressurization pump.

**8931.** If auxiliary (ambient) ventilation is selected during pressurized flight while at cruise altitude, what will happen?

1—Cabin pressure will increase.
2—Cabin compressor will overspeed.
3—Cabin altitude will increase.
4—Conditioned air efficiency will increase.

**8932.** The cabin pressure control setting has a direct influence upon the

1—outflow valve opening.
2—cabin supercharger compression ratio.
3—pneumatic system pressure.
4—turbocompressor speed.

**8933.** What component of a pressurization system prevents the cabin altitude from becoming higher than the airplane altitude?

1—Cabin rate of descent control.
2—Negative pressure relief valve.
3—Supercharger overspeed valve.
4—Compression ratio limit switch.

**8934.** If the cabin rate of climb is too great, what control adjustment should be made?

1—Cause the outflow valve to close slower.
2—Increase the cabin compressor speed.
3—Cause the outflow valve to close faster.
4—Decrease the cabin compressor speed.

**8935.** Should the cabin air compressor become disengaged, what prevents a loss of pressurization?

1—Firewall shutoff valve.
2—Supercharger disconnect mechanism.
3—Cabin pressure outflow valve.
4—Delivery air duct valve.

**8936.** How does the air-cycle cooling system produce cold air?

1—Routing conditioned air through the cooling fan.
2—Passing heated air through a compressor.
3—Passing air through cooling coils that contain a refrigerant.
4—Extracting heat energy across an expansion turbine.

**8937.** An airplane is cruising at 19,000 feet when the automatic cabin pressurization controls fail. Using manual controls, the cabin altitude is stabilized at 4,000 feet. If the airplane climbs 500 feet and the manual control setting is not changed, how will the cabin altitude be affected?

1—It will remain at 4,000 feet.
2—The cabin will climb slowly to 18,500 feet.
3—The cabin will descend to 3,500 feet.
4—It will climb to 4,500 feet.

**8938.** Turbojet airplane fuselages are subject to five major stresses. How is the stress of pressurization classified?

1—Tension stress.
2—Compression stress.
3—Torsion stress.
4—Shear stress.

**8939.** Which best describes cabin differential pressure?

1—The ratio between ambient pressure at flight altitude and that of the departure airport.
2—The ratio between the internal and external air pressures acting on the aircraft.
3—Comparative figure between the pressure flight altitude and the pressure altitude at the departure airport.
4—The difference between the cabin pressure controller setting and the actual cabin pressure.

**8940.** What are the operating cabin pressurization ranges typically found in pressurized aircraft?

1—Isobaric, differential, and maximum differential.
2—Differential, unpressurized, and isobaric.
3—Ambient, unpressurized, and isobaric.
4—Unpressurized, differential, and ambient.

**8941.** Regarding cabin pressurization, which is correct?

1—Bleed air from a gas-turbine engine cannot be used for pressurization due to contamination of the air from the gases of combustion.
2—Gas-turbines cannot source pressurization air due to high operating temperatures.
3—Bleed air from gas-turbine engines is frequently used as a source of pressurization air because it is free from contamination.
4—Gas-turbines are a common source of bleed air for pressurization, but first must be routed through an air cycle machine.

**8942.** How are turbojet engine temperatures measured?

1—Use of iron/constantan thermocouples.
2—Installing electrical resistance thermometers.
3—Use of chromel/alumel thermocouples.
4—Installing ratiometer electrical resistance thermometers.

**8943.** If a large turbojet powered aircraft has a takeoff weight that is 105 percent of the maximum landing weight, what system must be installed on the aircraft.

1—Fuel jettison.
2—Fuel injection.
3—Crossfeed bypass.
4—Fuel transfer.

**8944.** On large turbojet aircraft, how is fuel dumping usually accomplished?

1—Through a common manifold and outlet in each wing.
2—By gravity flow into the outboard wing tanks and overboard through a common outlet in each wing.
3—By pump pressure into the crossfeed manifold and then overboard through the vent lines.
4—Through individual outlets in each tank.

**8945.** What comprises a fuel dump system?

1—Filters, switches, valves, dump chutes, and chute operating mechanisms.
2—Lines, valves, dump chutes, and chute operating mechanisms.
3—Tanks, filters, valves, lines, dump chutes, and chute operating mechanisms.
4—Flowmeters, filters, valves, lines, dump chutes, and chute operating mechanisms.

**8946.** When fuel dumping operations are in effect, what is employed to maintain lateral stability?

1—Two separate and independent systems.
2—Crossfeed system.
3—Two interconnected systems.
4—An equalizer system.

**8947.** When is a fuel dumping system required on a large turbojet powered aircraft?

1—On all aircraft in the transport category.
2—Any turbine aircraft with a gross weight in excess of 12,500 pounds.
3—Both general aviation and transport category aircraft when maximum landing weight exceeds maximum takeoff weight.
4—On transport category, and some general aviation aircraft when maximum takeoff weight may exceed maximum authorized landing weight.

**8948.** For operations involving defueling of a turbojet powered airplane of sweptwing configuration, which procedure must be followed?

1—Defuel all the tanks at one time.
2—Fuselage tanks should be defueled last.
3—Defuel the inboard wing tanks first.
4—Outboard wing tanks should be defueled first.

**8949.** When fueling a turobjet aircraft by the pressure fueling method, what important precaution should be observed?

1—Truck pump pressure must be compatible with the aircraft fuel system pressure.
2—Truck pump pressure must be adjusted for minimum filter pressure.
3—To avoid static discharges, hoses must be connected before grounding.
4—The aircraft electrical system must be on to provide fuel quantity indications.

**8950.** Where are aircraft pressure fueling instruction placards usually located in a turbojet airplane?

1—On the flightcrew checklist.
2—On the fuel control panel access door.
3—Adjacent to the access door on the lower wing surface.
4—Located on the ground crew checklist.

**8951.** Entrained water in aviation turbine fuel is very susceptible to freezing as it passes through the filters. Which is a common prevention method?

1—Adding deicing fluid to the fuel.
2—Installing micromesh fuel strainers.
3—Use of high-velocity fuel pumps.
4—Use of anti-icing fuel additives.

**8952.** Why are turbine fuels more susceptible to water contamination than aviation gasoline?

1—Turbine fuel has a higher viscosity than gasoline.
2—Condensation is greater because of the rapid burn-off of turbine fuels.
3—Turbine fuel is lighter than gasoline, therefore water is more easily suspended.
4—Processing and handling of turbine fuels is less stringent than gasoline.

**8953.** What is the difference between turbine fuel Jet A and Jet A-1?

1—No difference since the numbers only indicate different manufacturers.
2—Jet A is for use in older turbine aircraft, while Jet A-1 is formulated for the newest aircraft.
3—Jet A is made for operation at extremely low temperatures.
4—Jet A-1 is made for operation at extremely low temperatures.

**8954.** Turbine fuels are blends of heavy distillates and tend to absorb water. Water droplets combine with fuel to form a frozen substance commonly referred to as

1—gel.
2—microbials.
3—suspensions.
4—sediment.

**8955.** Which turbine fuel would be the most appropriate for flight operations in temperatures between -40 F and -58 F?

1—Jet A.
2—Jet A-1.
3—Jet B.
4—Either Jet A or Jet A-1.

**8956.** A sample of turbine fuel appears cloudy at the top and clear at the bottom. This indicates the presence of

1—entrained water.
2—air in the fuel.
3—a combination of Jet A and Jet A-1.
4—aviation gasoline.

**8957.** After securing a sample of Jet A fuel from a turbojet sump a cloudiness is observed at the bottom of the sample. What does this indicate?

1—The presence of gasoline.
2—The Jet A has been contaminated with other fuels.
3—Air is suspended in the fuel.
4—Water is entrained in the fuel.

**8958.** Why are turbine fuels more susceptible to contamination than aviation gasoline?

1—The higher viscosity of turbine fuel has greater ability to hold contaminants.
2—Turbine fuels are less refined than gasoline, therefore have less tolerance to contamination.
3—The lower viscosity of turbine fuel has a greater ability to hold contaminants in suspension.
4—Turbine fuel systems, due to their high fuel flow rates, have less filtration than gasoline systems.

**8959.** In a turbojet engine, which is a disadvantage of using aviation gasoline mixed with turbine fuel?

1—Turbine inlet temperatures will be excessive.
2—The TEL in gasoline will form deposits on the turbine blades and vanes.
3—Toluene suspended in the gasoline will deteriorate the seals and fittings in the fuel system.
4—The gasoline will separate in the system causing a change in the compression ratio and compressor stall.

**8960.** Which would be most effective in controlling microbial growth in turbine fuels?

1—The addition of approved insecticides to the fuel.
2—The exclusive use of Jet B fuels.
3—The use of fuel additives which remove free water from the fuel.
4—Fueling operations only from trucks providing a micromesh filtration system from truck to aircraft.

**8961.** What is a fuel totalizer as installed in a turbojet aircraft?

1—Unit which measures the amount of fuel being delivered to each engine.
2—Gauge showing the amount of fuel in any given tank.
3—Component indicating the total rate at which all engines are consuming fuel.
4—Component indicating the amount of fuel in all the fuel tanks.

**8962.** Which is a means of controlling the fuel temperature on turbojet-powered aircraft?

1—Electrically heated fuel filters.
2—Fuel filters heated by engine lubricating oil.
3—Engine bleed air routed around the fuel tanks.
4—Engine bleed air routed to a heat exchanger.

**8963.** On turbine-powered aircraft, what method is used to determine possible fuel icing conditions?

1—Fuel pressure warning.
2—Fuel pressure gauge.
3—Fuel strainer pressure gauge.
4—Fuel temperature indicator.

**8964.** For what purpose is a fuel temperature indicator installed on some turbine-powered aircraft?

1—To correct fuel quantity indicated readings when temperature is other than standard.
2—Determine if fuel temperatures are conducive to ice crystal formation.
3—Determine if fuel temperatures are beyond limits for proper combustion.
4—To prepare for possible vapor locking when fuel temperatures exceed certain values.

**8965.** During ground operations, how is the starter-generator of a turbojet aircraft normally cooled?

1—Ram air.
2—Engine bleed air.
3—An integral fan.
4—The environmental system cooling air.

**8966.** During flight operations, how is the starter-generator on a turbojet aircraft normally cooled?

1—Cooling air from the air cycle machine.
2—Ram air and an integral fan.
3—Engine bleed air.
4—An external motor-driven fan.

**8967.** Which type of fire detector circuit can continue to function with either one open or one short in the detector loops?

1—Single-wire thermal switch.
2—Two-wire thermal switch.
3—Continuous loop.
4—Thermocouple.

**8968.** In fuel tanks, how is aircraft fuel capacity rated?

1—Volts.
2—Ohms.
3—Amperes.
4—Watts.

**8969.** What is the function of the circuit breaker in the instrument lighting system of most turbine aircraft?

1—Protects the lights from too much current.
2—Protects the wiring from too much current.
3—Prevents excessive voltage from reaching the lights.
4—Prevents excessive voltage from reaching the wiring.

**8970.** Which is considered to be an intermittent duty circuit in a turbojet aircraft?

1—Anticollision light circuit.
2—Landing light circuit.
3—Instrument panel light circuit.
4—Navigation light circuit.

**8971.** As installed in an aircraft electrical system, what is a relay?

1—A magnetically operated switch.
2—A device which increases voltage.
3—Unit which converts electrical energy to heat energy.
4—Any conductor which receives electrical energy and passes it on with little or no resistance.

**8972.** The primary purpose of a takeoff warning system is to alert the crew that a flight control is not properly set prior to takeoff. In a turbojet airplane, how is this system actuated?

1—Closing the landing gear retract switch.
2—Activation of the ground proximity switch (squat switch).
3—Closing of the thrust lever switch.
4—Opening of the thrust lever switch.

**8973.** Which of the following conditions would most likely cause the landing gear warning signal to be activated in a turbojet airplane?

1—Landing gear not locked down, throttle advanced.
2—Landing gear locked down, flaps up, throttle retarded.
3—Throttle retarded, landing gear locked down.
4—Throttle retarded, flaps up, landing gear in transit.

**8974.** A turbojet aircraft is equipped with heated inlet ducts and airfoil leading edges. When is this type of anti-icing system usually activated during flight?

1—Operated continuously while in flight.
2—In symmetric cycles during icing conditions to remove ice as it accumulates.
3—At all times when the outside air temperature is below freezing.
4—Whenever icing conditions are first encountered, or expected to occur.

**8975.** What are three possible sources of heated air for the turbojet wing thermal anti-icing system?

1—Turbo-compressors, air storage tank, and vacuum pump.
2—Engine bleed air, vacuum pump, and compressed air tank.
3—Engine bleed air, combustion heaters, and augmenter tubes.
4—Combustion heaters, augmenter tubes, and exhaust gases.

**8976.** In an electrically heated windshield system, what maintains normal windshield temperature?

1—Thermal overheat switches.
2—Autotransformérs.
3—Thermistors.
4—Electronic amplifiers.

**8977.** What name is given to smoke detectors that use a measurement of light transmissibility?

1—Electromechanical sensors.
2—Photoelectric devices.
3—Visual devices.
4—Electromeasuring sensors.

**8978.** Which fire detection systems measure temperature rise compared to a reference temperature?

1—Fenwal continuous loop.
2—Thermal switch.
3—Lindberg continuous element.
4—Thermocouple.

**8979.** Which instruments detect smoke in the cargo and/or baggage compartment of a turbojet airplane?

1—Visual scanner.
2—Chemical reactor.
3—Photoelectric cell.
4—Sniffer.

**8980.** Concerning the operation of photoelectric smoke detectors, which statement is correct?

1—Photoelectric smoke detectors measure the amount of smoke under a specific set of conditions.
2—Photoelectric smoke detectors measure the amount of light available under a specific set of conditions.
3—Photoelectric smoke detectors warn only when smoke is present.
4—Dust, soot, or other contaminants will not affect a photoelectric smoke detector.

**8981.** When a turbojet airplane is equipped with a continuous-loop fire-detection system, which is the most common cause of false fire warnings?

1—Improper routing, or clamping of detector loops.
2—Moisture in the system.
3—Dents, kinks, or crushed sensors.
4—Sensors contaminated by aircraft fluids.

**8982.** How does a thermocouple fire-detection system cause the warning system to operate?

1—By generating a small current when heated.
2—Electrical resistance is decreased by heat.
3—Heat expands the unit and forms a ground for the warning system.
4—Heat application increases electrical resistance.

**8983.** Which causes the thermocouple fire-warning system to activate?

1—Slowly overheating turbine.
2—Specified target temperature.
3—Core resistance drop.
4—Rate of temperature rise.

**8984.** What are built-in fire-extinguishing systems ordinarily charged with?

1—Carbon monoxide and nitrogen.
2—Freon and nitrogen.
3—Carbon tetrachloride.
4—Sodium bicarbonate.

**8985.** During an engine fire, which will occur when the emergency shutoff valves are closed?

1—Fuel flow to the engine will be blocked.
2—Fire-warning systems will be deactivated.
3—Fire extinguishers will automatically discharge.
4—Fire-detection systems will be activated.

**8986.** On a built-in carbon dioxide fire-extinguishing system, how is a thermal discharge detected?

1—The yellow plastic disc in the thermal discharge line is discolored.
2—The red plastic disc in the thermal discharge line is ruptured.
3—The thermal plug is missing from the side of the bottle.
4—By a ruptured green disc in the thermal discharge line.

**8987.** Which indicates that a fire-extinguishing system has been intentionally discharged into a turbojet engine?

1—Absence of a blue disc on the side of the fuselage.
2—Missing red disc on the side of the fuselage.
3—Missing green disc on the side of the fuselage.
4—Absence of a yellow disc on the side of the fuselage.

**8988.** From a standpoint of toxicity and corrosion hazard, which fire-extinguishing agent is safest to use in turbojet airplanes?

1—Carbon dioxide.
2—Methyl bromide.
3—Chlorobromomethane.
4—All are adequately safe in aircraft use.

**8989.** In an axial-flow turbojet engine, at what point will the highest gas pressure occur?

1—Immediately after the turbine section.
2—At the turbine entrance.
3—Within the burner section.
4—At the compressor outlet.

**8990.** Which is a function of the nozzle diaphragm in a turbojet engine?

1—Decrease the velocity of exhaust gases.
2—Center the fuel spray in the combustion chamber.
3—Direct the flow of gases to strike the turbine buckets at a desired angle.
4—Direct the flow of gases into the combustion chamber.

**8991.** What is the profile of a turbojet engine compressor blade?

1—The shape of the blade root at the attachment point.
2—The leading edge of the blade.
3—A cutout that reduces blade tip thickness.
4—The curvature of the blade root.

**8992.** The fan rotational speed of a dual axial compressor forward fan engine is the same as the

1—accessory drive shaft.
2—low-pressure compressor.
3—forward turbine wheel.
4—high-pressure compressor.

**8993.** A false, or hung start, is often the result of

1—starter cutout after engine self-acceleration.
2—starter cutout before engine self-acceleration.
3—rich blow-out.
4—lean die-out.

**8994.** What is the function of the nozzle diaphragm located upstream of the turbine wheel?

1—Increase pressure of exhaust gases.
2—Increase velocity of heated gases flowing past the nozzle diaphragm.
3—Direct the flow of gases parallel to the chord line of the turbine buckets.
4—Decrease the velocity of heated gases flowing past the nozzle diaphragm.

**8995.** Which section of the turbojet engine provides proper mixing of the fuel and air?

1—Combustion section.
2—Compressor section.
3—Turbine section.
4—Accessory section.

**8996.** In a gas turbine engine, combustion occurs at a constant

1—volume.
2—pressure.
3—velocity.
4—density.

**8997.** Which is correct regarding gas turbine engines?

1—At low engine speeds, thrust increases rapidly with small increases in RPM.
2—At higher engine speeds, thrust increases rapidly with small increases in RPM.
3—Gas turbine engines operate less efficiently at high altitudes due to the lower temperature encountered.
4—Thrust delivered per pound of air consumed is less at high altitude than low altitude.

**8998.** Some high-volume turbojet engines are equipped with two-spool or split compressors. When operating these engines at high altitude, which is true?

1—Throttle must be retarded to prevent overspeeding of the two compressor rotors due to the lower density of the air.
2—Low-pressure rotor will increase in speed as the compressor load decreases in the lower density air.
3—Throttle must be retarded to prevent overspeeding of the high-pressure rotor due to the lower density air.
4—Low-pressure rotor will decrease in speed as the compressor load decreases in the lower density air.

**8999.** Gas turbine engines use a nozzle diaphragm which is located upstream from the turbine wheel. Which is a function of that nozzle diaphragm?

1—Decrease the velocity of the heated gases flowing past this point.
2—Direct the flow of gases parallel to the vertical line of the turbine buckets.
3—Increase the velocity of the heated gases flowing past this point.
4—Increase the pressure of the exhaust mass.

**9000.** Where is the highest gas pressure in a turbine engine?

1—At the outlet of the tailpipe section.
2—At the entrance to the turbine section.
3—In the entrance of the burner section.
4—At the outlet of the burner section.

**9001.** If an exhaust cone is placed aft of the turbine in a jet engine, what affect will this have on the exhaust?

1—Increase pressure and decrease velocity.
2—Increase pressure and increase velocity.
3—Decrease pressure and increase velocity.
4—Decrease pressure and decrease velocity.

**9002.** What is the function of the stator vane assembly at the discharge end of a typical axial-flow compressor?

1—Reduce drag on the first stage turbine blades.
2—Straighten airflow to eliminate turbulence.
3—Direct the flow of gases into the combustion chambers.
4—Increase air swirling motion into the combustion chambers.

**9003.** What is the function of the turbines near the rear of a jet engine?

1—Compress air heated in the combustion section.
2—Increase air velocity for propulsion.
3—Circulate air to cool the engine.
4—Drive the compressor section.

**9004.** When starting a turbojet engine, which is correct?

1—A hot start is indicated if the exhaust gas temperature exceeds specified limits.
2—An excessive lean mixture is likely to cause a hot start.
3—The engine should start between 60 and 80 seconds after the fuel shutoff lever is opened.
4—Release the starter switch as soon as an indication of light-off occurs.

**9005.** In the dual axial-flow or twin spool compressor system, which is driven by the first stage turbine?

1—$N_1$ and $N_2$ compressors.
2—$N_4$ compressor.
3—$N_2$ compressor only.
4—$N_1$ compressor only.

**9006.** What drives the fan in most turbofan engines?

1—The turbine driving the high pressure compressor.
2—The turbine driving the low pressure compressor.
3—A special fan turbine driving only the fan.
4—An electric motor driven by current from the combination starter-generator.

**9007.** When starting a turbojet engine, what indicates a hung start?

1—Exhaust gas temperature exceeds specified limits.
2—The engine fails to reach idle RPM.
3—RPM exceeds idle RPM but fails to reach full RPM.
4—EPR exceeds idle requirements, but fails to reach taxi requirements.

**9008.** What are the two main sections of a turbojet engine?

1—Combustion and exhaust.
2—Hot and cold.
3—Compressor and turbine.
4—Combustion and turbine.

**9009.** In a turbine engine, the aerodynamic airflow distortion which occurs when the speed of sound is reached, is known as

1—shock stall.
2—compressor stall.
3—turbine stall.
4—accelerated stall.

**9010.** What is the primary function of the exhaust cone on a turbojet engine?

1—Collect and convert exhaust gases into a solid low velocity exhaust vapor
2—Straighten the swirling exhaust gases.
3—Collect and convert exhaust gases into a solid high velocity exhaust jet.
4—Pipe the exhaust gases out of the airframe.

**9011.** What are the two functional elements in a centrifugal compressor?

1—Turbine and compressor.
2—Compressor and manifold.
3—Bucket and expander.
4—Impeller and diffuser.

**9012.** Which best describes a power turbine, sometimes referred to as a free power turbine?

1—The first turbine driving the compressor.
2—A turbine driving an accessory.
3—An extra turbine available to drive optional equipment.
4—A turbine rotor not connected to the compressor.

**9013.** Which is a turbine engine compressor with vanes on both sides of the impeller?

1—Single entry centrifugal compressor.
2—Double entry centrifugal compressor.
3—Double entry axial-flow compressor.
4—Single entry axial-flow compressor.

**9014.** When starting a turbine engine, which is the first engine indication of a successful start?

1—Decrease in exhaust gas temperature.
2—Rise in engine fuel flow.
3—Decrease in engine pressure ratio.
4—Rise in exhaust gas temperature.

**9015.** How does a dual axial-flow compressor improve upon the efficiency of a turbine engine?

1—More turbine wheels can be used.
2—Combustion chamber temperatures are reduced.
3—Higher compression ratios can be achieved.
4—Velocity of the air entering the combustion chamber is increased.

**9016.** Which symbol represents the speed of the low pressure compressor?

1—$N_1$.
2—$N_2$.
3—$N_c$.
4—$N_f$.

**9017.** Which is an advantage of the axial-flow compressor?

1—Low starting power requirements.
2—Low weight.
3—High peak performance.
4—High frontal area.

**9018.** What is the purpose of the stator blades in the compressor section of a turbine engine?

1—Stabilize pressure.
2—Prevent compressor surge.
3—Control airflow direction.
4—Increase airflow velocity.

**9019.** What is the purpose of the diffuser section of a turbine engine?

1—Increase pressure and reduce velocity.
2—Speed up the airflow in the turbine section.
3—Convert pressure to velocity.
4—Reduce pressure and increase velocity.

**9020.** In a turbine engine, where is the diffuser section located?

1—Between the burner section and turbine section.
2—Aft of the $N_1$ and forward of the $N_2$ section.
3—Between station No. 7 and No. 8.
4—Aft of the compressor section and forward of the burner section.

**9021.** Which are common thrust reversers used on modern turbojet aircraft?

1—Convergent and divergent.
2—Rotary and stationary air vane.
3—Mechanical blockage and aerodynamic blockage.
4—Cascade vane and blocked door.

**9022.** Why is damage to turbine vanes more likely to be greater than damage to compressor vanes?

1—Greater stresses found in the combustor.
2—Turbine vanes are subject to greater heat stress.
3—Thrust clearances are greater in turbine vanes.
4—Turbine vanes are subjected to greater vibration and other internal stresses.

**9023.** Which is the ultimate limiting factor in turbojet engine operation?

1—Compressor air inlet temperature.
2—Compressor outlet air temperature.
3—Turbine inlet temperature.
4—Burner-can pressure.

**9024.** In centrifugal compressor turbine engines, how is the turbine shaft usually joined to the compressor rotor?

1—Bolted coupling.
2—Keyed coupling.
3—Welded coupling.
4—Splined coupling.

**9025.** Which is the most critical engine variable during turbine engine operation?

1—Compressor inlet air temperature.
2—Compressor RPM.
3—Burner-can pressure.
4—Turbine inlet temperature.

**9026.** In turbine engines, how are improved airflow characteristics and reduced blade vibration achieved?

1—Through fir-tree blade attachments.
2—Use of impulse-type turbine blades.
3—Through shrouded turbine rotor blades.
4—Use of bulb-root attachment of turbine blades.

**9027.** Which turbojet engine compressor offers the greatest advantages in starting flexibility and improved high-altitude performance?

1—Single-stage, centrifugal-flow.
2—Dual-stage, centrifugal-flow.
3—Split-spool, axial-flow.
4—Single-spool, axial-flow.

**9028.** Which is an advantage of the centrifugal-flow compressor?

1—High frontal area.
2—High pressure rise per stage.
3—Greater ram efficiency.
4—Greater peak efficiency.

**9029.** In a jet engine, where will you find the highest heat-to-metal contact?

1—In the burner cans.
2—At the end of the exhaust cone.
3—On the turbine inlet guide vanes.
4—On the turbine blades.

**9030.** Identify the symbol for the speed of the high pressure compressor?

1—$N_1$.
2—$N_2$.
3—$N_c$.
4—$N_f$.

**9031.** Which symbol identifies total pressure?

1—$T_t$.
2—$P_t$.
3—$P_j$.
4—$P_b$.

**9032.** In a turbine engine compressor, what do you call the row of stationary blades found between each row of rotating blades?

1—Buckets.
2—Expanders.
3—Diffusers.
4—Stators.

**9033.** If turbine blades are subjected to excessive temperatures, what type of failure may be expected?

1—Compression and torsional failure.
2—Bending and torsional cracking.
3—Torsion and suspension damage.
4—Stress rupture.

**9034.** With an axial-flow compressor, what is one purpose of the stator vanes at the discharge end of the compressor?

1—Prevent compressor surge and eliminate stalls.
2—Straighten the airflow and eliminate turbulence.
3—Increase the velocity and prevent swirls and eddies.
4—Decrease the velocity, prevent swirling, and decrease pressure.

**9035.** Which is a possible result of dirty compressor blades?

1—Low RPM.
2—Low EGT.
3—High RPM.
4—High EGT.

**9036.** Name the two types of compressors most commonly found in modern jet engines?

1—Axial and root.
2—Centrifugal and reciprocating.
3—Root and centrifugal.
4—Centrifugal and axial.

**9037.** In an axial-flow engine, what purpose is served by shrouds on the turbine blades?

1—Reduce vibration.
2—Shorten run-in time.
3—Increase tip speed.
4—Reduce air entrance.

**9038.** In a dual axial-flow jet engine, what is driven by the first stage turbine?

1—$N_2$ compressor.
2—$N_1$ compressor.
3—Low pressure compressor.
4—Both low and high pressure compressors.

**9039.** If a turbojet engine catches fire during the start cycle, what should be done?

1—Turn off the fuel and continue cranking.
2—Disengage starter immediately.
3—Continue starting to blow out the fire.
4—Place power lever in increase to purge fuel fumes.

**9040.** For a turbojet engine, what is the proper start sequence?

1—Ignition, starter, then fuel.
2—Fuel, starter, then ignition.
3—Starter, ignition, then fuel.
4—Starter, fuel, then ignition.

**9041.** Which is a common cause of inflight turbojet engine flameouts?

1—High exhaust gas temperature.
2—Interruption of the inlet airflow.
3—Fouling of the primary igniter plugs.
4—Fuel-nozzle clogging.

**9042.** Which units aid in compressor stabilization during low thrust engine operations?

1—Bleed air valves.
2—Stator vanes.
3—Inlet guide vanes.
4—Pressurization and dump valve.

**9043.** In a turbine engine with a dual-axial compressor, which is correct regarding the low speed compressor?

1—It always turns at the same speed as the high speed compressor.
2—It is connected directly to the high speed compressor.
3—The assembly seeks its own best operating speed.
4—The unit has a higher compressor shaft speed than the high speed compressor.

**9044.** On a centrifugal compressor, what is the function of the inlet guide vane assembly?

1—Directs air into the first stage rotor blades at the proper angle.
2—Converts velocity energy into pressure energy.
3—Converts pressure energy into velocity energy.
4—Picks up air and adds energy as it accelerates outward by centrifugal force.

**9045.** What purpose is served by the stator vanes in an axial-flow compressor?

1—Convert velocity energy into pressure energy.
2—Convert pressure energy into velocity energy.
3—Direct air into the first stage rotor vanes at the proper angle.
4—Add energy to ram air by diffusing action resultant of axial force.

**9046.** When air flows through a convergent nozzle, how is velocity affected?

1—Decreases.
2—Remains constant.
3—Inversely proportional to temperature.
4—Increases.

**9047.** How is velocity affected when air flows through a divergent nozzle?

1—Increases.
2—Remains constant.
3—Varies proportional with temperature.
4—Decreases.

**9048.** When air flows through a convergent nozzle, how is the pressure affected?

1—Increases.
2—Decreases.
3—Unchanged.
4—Increases and decreases with temperature changes.

**9049.** What happens to pressure when air flows through a divergent nozzle?

1—Decreases.
2—Remains constant.
3—Increases.
4—Expands and cools.

**9050.** How is anti-icing of turbojet air inlets accomplished?

1—Electric heating elements inside the inlet guide vanes.
2—Hot air ducted over the outside of the inlet guide vanes.
3—Engine bleed air ducted through the critical areas.
4—Electric heating elements located within the inlet.

**9051.** During turbojet engine start, when should the starter be disengaged?

1—As soon as engine lights are off on annunciator panel.
2—When the engine reaches idle RPM.
3—When the RPM indicator shows 100 percent.
4—As soon as ignition and fuel systems are actuated.

**9052.** What advantages, if any, does the axial-flow compressor have over a centrifugal compressor?

1—Easier maintenance.
2—High frontal area.
3—Less expensive.
4—Greater pressure ratio.

**9053.** Fuel weight is symbolized as

1—$N_f$.
2—$T_f$.
3—$W_f$.
4—$F_g$.

**9054.** What is a double entry centrifugal compressor?

1—A compressor with two intakes.
2—A two stage compressor independently connected to the main shaft.
3—Two compressors and two impellers mounted in tandem.
4—A compressor with vanes on both sides of the impeller.

**9055.** What is the major function of the turbine assembly in a turbojet engine?

1—Compresses the air before it enters the combustion section.
2—Directs the gases in the proper direction to the exhaust nozzle.
3—Supplies the power to turn the compressor.
4—Increases the temperature of the exhaust gases.

**9056.** What is the function of stator blades installed in the compressor section of an axial-flow turbine engine?

1—Increase the air velocity and prevent swirling.
2—Straighten and accelerate the air flow.
3—Decrease the air velocity and prevent swirling.
4—Stabilize the airflow to prevent compressor surge.

**9057.** What three main sections comprise a gas turbine engine, installed on a turbopropeller airplane?

1—Compressor, diffuser, and scavenge.
2—Turbine, combustion, and scavenge.
3—Compressor, combustion, and inlet guide vane.
4—Compressor, combustion, and turbine.

**9058.** Which is the most commonly used turbine blade?

1—Convergent.
2—Divergent.
3—Fir-tree.
4—Reaction-impulse.

**9059.** What is the primary factor controlling the pressure ratio of an axial-flow compressor?

1—The number of stages in the compressor.
2—Rotor diameters.
3—Compressor inlet pressures.
4—Compressor inlet temperatures.

**9060.** What comprises the main sections of a turbojet engine?

1—Fan, combustion, and exhaust.
2—Compressor, combustion, and diffuser.
3—Compressor, combustion, and turbine.
4—Inlet, combustion, and turbine.

**9061.** Which is not a factor to the operation of an automatic fuel control unit?

1—Compressor inlet air density.
2—Compressor RPM.
3—Mixture control position.
4—Throttle position.

**9062.** Newton's First Law of Motion, the Law of Inertia, states in general that

1—for every action there is an equal and opposite reaction.
2—a force is proportional to the product of mass and acceleration.
3—every body persists in its state of rest, or motion in a straight line, unless acted upon by some outside force.
4—a force applied to an object at any point is transmitted in every direction without loss.

**9063.** A turbine engine hot section is very susceptible to which kind of damage?

1—Scoring.
2—Pitting.
3—Cracking.
4—Galling.

**9064.** With turbojet engines, dirt particles in the free air may be introduced into the compressor, forming a coating on all items except

1—turbine blades
2—compressor blades.
3—internal casings.
4—inlet guide vanes.

**9065.** Which has an influence upon the operation of the automatic fuel control unit?

1—Fuel temperature.
2—Burner pressure.
3—Mixture control position.
4—Exhaust gas temperature.

**9066.** While en route at FL310, the first officer of an air carrier airplane leaves the duty station for physiological purposes. In this event, the flight engineer

1—must have a quick-donning type oxygen mask available.
2—must select emergency oxygen and put on an oxygen mask.
3—need not put on an oxygen mask.
4—shall put on and use an oxygen mask.

**9067.** When used for cooling purposes, where is water injected into a turbojet engine?

1—At the compressor air inlet or diffuser.
2—At the second-stage compressor or turbine.
3—In the burner can.
4—In the outlet of the fuel control.

**9068.** If compressor blades are continuously subjected to excessive heat and/or centrifugal force, what is likely to be caused?

1—Profiling.
2—Blade growth.
3—Gouging.
4—Galling.

**9069.** An air carrier airplane with a seating capacity of 150 passengers is carrying 75 passengers. If two portable battery-powered megaphones are on board the airplane, where should they be located?

1—One located near or accessible to the flightcrew, and the other located near the center of the passenger cabin.
2—One located at the most rearward location in the passenger cabin, the other is not required for only 75 passengers.
3—One of the two positioned in the approximate center of the cabin seating configuration, and the other at the entrance to the flightcrew compartment.
4—One at the most forward end, and the other at the most rearward location of the passenger cabin.

**9070.** The compression ratio and an axial-flow compressor is a function of the

1—number of compressor stages.
2—rotor diameter.
3—diffuser area.
4—air inlet velocity.

**9071.** Which would affect the inlet air density of a turbine engine?

1—Compression ratio.
2—The speed of the aircraft.
3—Turbine inlet temperature.
4—Compressor efficiency.

**9072.** Which would affect the thermal efficiency of a turbine engine?

1—Ambient temperature.
2—Speed of the aircraft.
3—Turbine inlet temperature.
4—Aircraft altitude.

**9073.** Why do some turbine engines have more than one turbine wheel attached to a single shaft?

1—To facilitate balancing of the turbine assembly.
2—To straighten the airflow before it enters the exhaust.
3—Help stabilize the pressure between the compressor and the turbine.
4—Extract more power from the exhaust gases than a single wheel can absorb.

**9074.** The exhaust section of a turbojet engine is designed to

1—impart a high exit velocity to the exhaust gases.
2—swirl the exhaust gases.
3—increase temperature, therefore increasing velocity.
4—decrease temperature, therefore decreasing pressure.

**9075.** The flight engineer observes several fuel flow fluctuations with accompanying changes in temperatures. Who is responsible for noting this mechanical irregularity in the aircraft maintenance log?

1—Aircraft dispatcher after notification by the captain.
2—Flight engineer directly into the aircraft discrepancy log.
3—Pilot in command.
4—Certificate holder, or designated representative.

**9076.** Why does a turbine engine require a cool-off period prior to shutdown?

1—Allow the surfaces contacted by the lubricating oil to return to normal operating temperatures.
2—Burn off excess fuel ahead of the fuel control.
3—Allow the turbine wheel to cool before the case contracts around it.
4—Avoid seizure of the engine bearings when the hot oil evaporates away after shutdown.

**9077.** On a turbojet engine utilizing nine burner cans, how many igniters would normally be used?

1—One.
2—Two.
3—Six.
4—Nine.

**9078.** Which document contains approved procedures for continuing a flight when an item of required airplane equipment becomes inoperative?

1—Original dispatch release.
2—Certificate holder's manual.
3—Type certification data sheet.
4—Amended flight dispatch release.

**9079.** Permanent and cumulative deformation of turbine blades is commonly described as

1—stretch.
2—elongation.
3—distortion.
4—creep.

**9080.** On turbojet engines, what purpose does the pressurization and dump valve serve?

1—Controls the pressure of the compressor outlet by dumping air when pressure reaches an established level.
2—Allows fuel pressurization of the engine when starting and operating, and dumps fuel pressure at engine shutdown
3—Controls compressor stall by dumping compressor air under certain conditions.
4—Maintains fuel pressure to the fuel control valve and dumps excessive fuel back into the fuel tanks.

**9081.** In a turbojet engine, at what stage are pressures the greatest?

1—Compressor inlet.
2—Turbine outlet.
3—Compressor outlet.
4—Tailpipe.

**9082.** In what section is the nozzle found in a turbojet engine?

1—Combustion.
2—Turbine.
3—Compressor.
4—Exhaust.

**9083.** What publication would contain time or cycle limitations for components or parts of a turbine engine installed on a specific aircraft?

1—Instructions for continued airworthiness issued by the airplane manufacturer.
2—Federal Aviation Regulation, Part 33, Airworthiness Standards; Aircraft Engines.
3—FAA Advisory Circular 65-12A.
4—FAA Advisory Circular 43.13-1A.

**9084.** With respect to the aircraft, if the velocity of a turbojet engine remains constant, how will jet thrust be affected?

1—Jet thrust will increase if the speed of the aircraft is increased.
2—Jet thrust will decrease if the speed of the aircraft is increased.
3—Speed of the aircraft will not have an effect on jet thrust.
4—$V_i$ will cause a decrease in thrust value.

**9085.** Which will result in an increase in gas turbine engine thrust?

1—Increasing mass flow, or increasing jet velocity.
2—Decreasing mass flow, or decreasing jet velocity.
3—Changing mass flow through the engine into jet velocity.
4—Changing jet velocity through the engine into mass flow.

**9086.** A clamshell-type thrust reverser is an example of

1—an aerodynamic-blockage reversing system.
2—a mechanical-blockage type reversing system.
3—a drag bucket speed reduction system.
4—an aeromechanical-blockage reversing system.

**9087.** Which is responsible for the greatest amount of turbojet engine noise?

1—High speed air in the engine air intake.
2—The high pitch whine of the high speed compressors.
3—The high degree of turbulence from the high velocity jet stream downstream of the engine.
4—Exhaust combustion roar created by the turbines and burners.

**9088.** Name two types of turbojet engine noise suppressors for use in airborne operations?

1—Corrugated-perimeter and multi-tube.
2—Snubber and clamshell.
3—Mechanical blockage and aerodynamic blockage.
4—Convergent and divergent nozzle.

**9089.** When comparing turbojet and turbofan engines of the same size, which will be more quiet during takeoff?

1—The turbojet due to the variable nozzle.
2—The turbofan due to higher speed exhaust gases exiting at a frequency above the human audibility range.
3—The turbojet because it utilizes smaller and higher speed turbines.
4—The turbofan principally because the exhaust gases are slower than those of a turbojet of comparative size.

**9090.** Which best describes, "rich blowout?"

1—Occurs when the fuel quantity is reduced proportionally below the air quantity.
2—When the mixture is cooled below the combustion temperature by the excess fuel.
3—The limiting temperature of the turbine blades is exceeded, resulting in excessive combustion temperature.
4—Anytime a flameout occurs with the fuel condition lever forward of the idle position.

**9091.** When the amount of oxygen in the air supply is insufficient to support combustion, this will result in the condition known as

1—rich blowout.
2—lean blowout.
3—overtemp.
4—petro-mechanical stall.

**9092.** If the fuel quantity delivered to the engine is reduced proportionally below the air quantity

1—a serious overtemp may occur.
2—"rich blowout" may occur.
3—"lean die-out" may be expected.
4—the fuel control unit is likely to vapor lock.

**9093.** Which is correct regarding the fuel control units used on modern turbojet and turbofan engines?

1—The fuel requirements of the engine are automatically satisfied without use of an external mixture control.
2—Each is equipped with power and mixture controls similar to reciprocating engines.
3—They are simple fuel metering devices consisting of few moving parts and requiring little or no maintenance.
4—Fuel control units are equipped with automatic mixture controls which operate automatically above standard altitude.

**9094.** During a "slam acceleration," how may the fuel system be affected?

1—Fuel flow will be insufficient and a "lean blowout" may occur.
2—An overrich mixture can be produced with the possibility of a "rich blowout."
3—The fuel controller will compensate and allow acceleration at a prescribed rate regardless of power lever position.
4—The fuel controller will lag sufficiently until the engine has spooled up enough to accept the additional fuel.

**9095.** Of the two basic groups of fuel controllers which type is most commonly found on turbojet and turbofan engines?

1—Electromechanical.
2—Hydraulic.
3—Electronic.
4—Hydromechanical.

**9096.** On turbojet and turbofan engines, how is fuel prevented from dripping into the combustion chambers from the fuel manifold when the engine is stopped?

1—A spring-loaded, solenoid operated drain opens when fuel pressure drops below a specified minimum.
2—The spool-down airflow through the engine purges the manifolds.
3—The fuel nozzles are automatically closed whenever the fuel pressure drops below a prescribed minimum.
4—An electrically operated solenoid prevents the fuel from flowing through the manifold until adequate fuel pressure is available.



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**9097.** Fuel entering the inlet port of the fuel control unit must pass through a coarse 200-mesh screen filter. If this filter becomes clogged with contaminants, what will happen?

1—Fuel flow will cease, igniters will be extinguished, and the engine will flame out.
2—The filter is spring loaded and will allow unfiltered fuel to bypass the filter when differential pressure is greater than 25 to 30 PSI.
3—The fuel filter bypass can be activated through a warning light and filter bypass solenoid.
4—A fuel filter warning light will be illuminated, representing a 30 minute fuel reserve available from an accumulator before automatic engine shutdown.

**9098.** On warm days, thrust is reduced because of the decrease in air density. How can this be best compensated in the turbojet engine?

1—Through the use of variable inlets and adjustable nozzles.
2—Opening alternate air doors to lower combustion temperatures.
3—Water injected at the compressor inlet or diffuser case.
4—Alcohol injected at the air inlet or directly into the fuel manifolds.

**9099.** If a water injection system is not armed in the cockpit, or if there is no water available, what will happen, if anything, when the water injection switch in the fuel control unit is activated?

1—Nothing will happen.
2—Engine RPM will increase in anticipation of water injection with the possiblity of an overtemp condition.
3—The water injection re-set servo will prevent excessive engine RPM, but temperatures will have to be monitored through the cockpit.
4—You cannot activate the water injection switch in the fuel control unit if there is no water available.

**9100.** What is the minimum number of acceptable oxygen-dispensing units for first aid treatment of occupants who might require undiluted oxygen for physiological need?

1—Six.
2—Four.
3—Three.
4—Two.

**9101.** How does deadhead transportation affect the computation of flight time limits for air carrier flight crewmembers? It is

1—allowed to be included as part of the required rest period for flag air carrier flightcrews.
2—not considered as part of any required rest period.
3—considered part of the required rest, if the flightcrew includes more than two pilots.
4—considered as part of the required rest for flight engineers and flight navigators.

**9102.** When conducting overwater operations, where are life preservers stored?

1—Aft of the cockpit bulkhead.
2—In the passenger compartment, at the rearmost location.
3—Adjacent to each emergency exit.
4—Within easy access in the event of ditching.

**9103.** If a micron-type filter becomes saturated with water, what can occur?

1—Water can be allowed to pass and quickly damage the fuel pump and fuel control units.
2—The filter will always become plugged, resulting in either stoppage of flow, or interrupted power.
3—A filter warning light will illuminate requiring change of filters at the next base of operations.
4—Due to their construction design, micron filters cannot become saturated, only plugged with contamination.

**9104.** What action by the flight engineer can reduce, or eliminate filter trouble and prevent undue maintenance of pumps and fuel control units?

1—Careful trend monitoring of essential engine lifebloods.
2—Regular draining of fuel tank sumps and low pressure filters during the preflight.
3—Logging of illuminated annunciators related to the fuel control system.
4—Maintaining liaison with maintenance personnel at each base of operation with regard to results of trend monitoring.

**9105.** Which type fuel nozzle is most common to modern turbine engines?

1—Simplex.
2—Duplex.
3—Flow divider.
4—Atomizer.

**9106.** What is the size of a Micron?

1—1/1000 of an inch.
2—About one half the diameter of a human hair.
3—1/1000 of a millimeter.
4—About the size of the head of a pin.

**9107.** What happens to fuel accumulated in the combustion chambers after a shutdown, or false start?

1—Excess fuel evaporates rapidly from engine heat.
2—Fuel accumulations are drained through pressure differential or solenoid operated drain valves.
3—Fuel accumulations are blown out the tailpipe after the next activation of the starter.
4—The fuel is immediately burned off at the next start cycle.

**9108.** Which condition could cause the fuel counter (totalizer) to be inaccurate?

1—Unbalanced fuel loads.
2—Changes in outside air temperature.
3—Jettisoned fuel after airborne.
4—Use of fuel additives such as antimicrobials.

**9109.** The fuel totalizer (counter) may be inaccurate when

1—the unit is not calibrated for changes in brands of fuels.
2—temperatures other than standard.
3—unequal fuel loads.
4—line and tank leaks upstream of the flowmeter.

**9110.** What type of ignition system is used on most turbojet engines?

1—High tension center electrode spark plugs located in each burner can.
2—High tension platinum electrode spark plugs located in every other burner can.
3—High-energy, capacitor igniters located in specified combustion chambers.
4—Specially designed high resistance glow plugs installed in specified combustion chambers.

**9111.** If a turbojet engine is equipped with a modified-type electronic ignition system, when is its usage required?

1—During takeoff through the climb out, then through the approach and landing.
2—Required only for starting and specialized weather situations.
3—Continuous from starting to shut-down.
4—Anytime fuel temperature falls below 0°C.

**9112.** Which is correct concerning a starter-generator system?

1—The unit is either a starter or generator depending on switch position.
2—This is the generator which supplies current necessary to engage the starter.
3—The unit functions as an a.c. starter until switched off.
4—The starter-generator functions as a d.c. starter until the engine reaches a predetermined self-sustaining speed.

**9113.** The fuel/air combustion starter is used primarily for

1—long range, air carrier flights.
2—short-flight, air carrier aircraft.
3—small business jets only.
4—aircraft with full support services available.

**9114.** Most turbojet engines of the axial-flow configuration, utilize what type of lubrication system?

1—Dry sump.
2—Integrated pump.
3—Hopper tank and scupper.
4—Wet sump.

**9115.** What type of turbojet lubrication system has the oil supply tank mounted on the engine?

1—Integrated pump.
2—Hopper tank and scupper.
3—Wet sump.
4—Dry sump.

**9116.** Which turbojet engine is most likely to have a wet-sump lubrication system?

1—Axial flow.
2—Centrifugal flow.
3—Dual axial flow.
4—Turbofan.

**9117.** In a turbojet engine, surplus air cools the hot sections to an acceptable

1—300 to 700°F.
2—700 to 1,100°F.
3—1,100 to 1,500°F.
4—1,500 to 1,900°F.

**9118.** Just before entering the turbine, how are the burnt gases cooled?

1—By passing through a heat exchanger.
2—Use of an expansion turbine just prior to the main power turbine.
3—Routing the hot gases through a cooling pack.
4—By mixing large amounts of surplus cool air aft of the burners.

**9119.** Why must nearly all cooling air be passed through the inside of the turbojet engine?

1—If only the necessary amount of air to provide an air/fuel ratio of 15:1 was admitted, internal temperatures would exceed 4,000°F.
2—There is no way of controlling airflow direction from outside of the engine.
3—The air is also utilized for compressor operation, therefore must have a large volume.
4—The air not used for cooling must be converted for use as additional thrust.

**9120.** The two major types of turbine failures are classified as either

1—catastrophic or simplistic.
2—thermodynamic or mechanical.
3—aerodynamic or static.
4—potential or kinetic.

**9121.** In general, ice, excess air bleed or leakage, and faulty controls which result in compressor stall are usually associated with which type of failure?

1—Mechanical.
2—Aerodynamic.
3—Thermodynamic.
4—Kinetic.

**9122.** Fractured or thrown turbine blades are examples of

1—thermodynamic failure.
2—kinetic failure.
3—anterial failure.
4—mechanical failure.

**9123.** Name the two subsystems comprising the turbojet engine fire protection system.

1—Fire detection and fire extinguishing.
2—Fire bottles and fire dispersant discharge tubes.
3—Primary and secondary.
4—Audible and visual.

**9124.** What fire warning devices are usually found in the cockpit of a large turbojet aircraft?

1—T-handle and bottle pressure gauge.
2—Warning light for each circuit and common alarm bell for all circuits.
3—Thermodynamic and mechanical.
4—Fenwal and Kidde.

**9125.** Name two methods of distributing fire extinguishing agents into a turbojet engine.

1—Jet hose and sprinklers.
2—Nozzle or open end outlets.
3—Foggers and sniffle valves.
4—In-flow distribution and bursting bulbs.

**9126.** What three types of fire detectors are most commonly used on turbojet aircraft?

1—Rate of rise, radiation sensing, and overheat detectors.
2—Smoke, fiber optic detectors, and crew observation.
3—Carbon monoxide detectors, combustible mixture detectors, and radiation sensors.
4—Overheat detectors, smoke detectors and combustible mixture detectors.

**9127.** What color is the safety discharge connection cap of a fire extinguisher container?

1—Yellow.
2—Red.
3—Green.
4—White.

**9128.** If the fire alarm bell sounds for engine No. 4, and is silenced by the bell cutout switch, what will happen if a fire starts in engine No. 3?

1—No bell will sound because the bell cutout switch has already been activated.
2—No bell will sound, but the fire bottles will automatically be discharged into engine No. 3.
3—The bell can still respond to a fire signal from any of the remaining engines.
4—The bell will sound, but only after a fire bottle has discharged into engine No. 4.

**9129.** Which is not an engine power rating?

1—Maximum continuous.
2—Normal.
3—Maximum cruise.
4—Idle.

**9130.** Which is most accurate for measuring turbojet engine thrust?

1—Engine pressure ratio indicator.
2—Torquemeter.
3—Turbine discharge pressure indicator.
4—Turbine inlet temperature indicator.

**9131.** Which indicator compensates automatically for the effects of airspeed and altitude factors by considering compressor inlet pressure?

1—Turbine inlet temperature indicator.
2—Turbine discharge pressure indicator.
3—Engine pressure ratio indicator.
4—Exhaust gas temperature indicator.

**9132.** Turbojet engine speed is measured by

1—turbine RPM.
2—shaft RPM.
3—compressor RPM.
4—diffuser RPM.

**9133.** Why are turbojet tachometers usually calibrated in percent of RPM?

1—So that various types of engines can be operated on the same basis of comparison.
2—Engine speeds are so high that present tachometers cannot read the speed levels.
3—Measurement of RPM alone is not sufficient to measure the efficiency of the turbine.
4—Tachometers are not accurate enough to read precise RPM at turbine speeds.

**9134.** On engines equipped with clam-shell type thrust reversers, in which throttle position will the reversers be deployed?

1—Any speed above idle.
2—At idle speed with reversing levers in "reverse."
3—Maximum continuous power setting with reversing levers activated.
4—Positions below idle.

**9135.** Large turbojet aircraft engines are usually started by which method?

1—Each engine started individually by a ground cart.
2—First engine by ground cart, then combined cart and engine generator power to start subsequent engines.
3—First engine by ground cart pneumatic power, then air bleed from the first engine to start the others.
4—A combination of ground cart pneumatic power and operating engine power used continuously until all engines are operating within normal limits.

**9136.** Which is the first indication of a successful engine start?

1—Tachometer reading 10-12 percent power.
2—Rise in exhaust gas temperature.
3—Fuel flow off the peg and coming up.
4—Oil pressure stabilized within normal limits.

**9137.** When computing takeoff thrust, which temperature would be the most valuable?

1—Free air temperature obtained from the aircraft thermocouple.
2—Runway temperature, when available.
3—Control tower temperature.
4—Field temperature adjusted for relative humidity.

**9138.** When performing an after-start engine idle check, which instrument readings should be checked and compared?

1—Oil pressure, tachometer, and fuel flow.
2—Exhaust gas temperature, tachometer, and oil pressure.
3—Fuel flow, turbine discharge pressure, and exhaust pressure ratio.
4—Fuel flow, compressor inlet temperature, and RPM.

**9139.** When a large turbojet engine has been operated above approximately 85 percent RPM for periods exceeding 1 minute during the last 5 minutes prior to shutdown, it is recommended to

1—stage cool the engine in 20 percent increments for 5 minutes prior to shutdown.
2—operate the engine at idle for 5 minutes prior to shutdown to prevent possible seizure of the rotors.
3—cool the engine down by reducing fuel flow for 1 minute prior to shutdown.
4—motor the engine for 1 minute after shutdown to prevent hot spots and cool the turbines.

**9140.** During engine shutdown, when should the fuel boost pumps be turned off?

1—Immediately prior to placing the throttle or fuel shutoff levers in the off position.
2—After the throttle is closed and before the fuel shutoff lever is placed in the off position.
3—After the throttle is closed and after the fuel shutoff lever is placed in the off position.
4—At any time it is determined the engine driven pumps will not lose their prime as a result of shutdown.

**9141.** What problem may be encountered if an engine is shut down with the throttle set higher than idle?

1—This could result in high fuel pressures within the fuel control that can harm the fuel system parts.
2—The turbine will rotate longer without lubrication which can cause excessive bearing wear.
3—The engine may not shut down due to continuous combustion with the fuel nozzles open.
4—This procedure can purge the fuel pumps and controls of all fuel pressure causing loss of prime and hard starting.

**9142.** With regard to turbojet engine operations, what does the symbol "Pt7" mean?

1—Turbine discharge pressure.
2—Turbine inlet pressure.
3—Compressor discharge pressure.
4—Impeller ratio.

**9143.** When comparing the turbojet engine with a reciprocating engine, which is correct?

1—Turbojet engines are more susceptible to the effects of relative humidity than reciprocating engines.
2—The five events in the energy release cycle of a turbine engine are the same as those in a reciprocating engine.
3—The reciprocating engine extracts energy by a constant pressure cycle and the turbine engine does not.
4—The weight to power ratio of a reciprocating engine is more favorable than a turbine engine.

**9144.** Simply stated, what is Sir Isaac Newton's third law of motion using the applied principle of Hero's aeolipile?

1—What goes up, must come down.
2—When a gas is confined, the pressure varies inversely with the temperature.
3—As the velocity of a fluid or gas increases, pressure decreases, and conversely.
4—For every force action there is an equal and opposite force reaction.

**9145.** Of the four types of reaction engines used in aviation, which is a non-air-breathing engine?

1—Ramjet.
2—Pulsejet.
3—Rocket motor.
4—Turbojet.

**9146.** Comparing aircraft powered by turbojet and turbofan engines, which is correct?

1—The turbofan has a compression pressure of about half that of the turbojet.
2—Turbofan equipped aircraft have far better short-field takeoff characteristics.
3—Turbofan equipped aircraft cannot attain cruise speeds near that of the turbojet.
4—Turbojet equipped aircraft cannot attain cruise speeds near that of the turbofan.

**9147.** Which engine type offers the best fuel economy during operation?

1—Centrifugal flow turbojet.
2—High bypass turbofan.
3—Axial-flow compressor turbojet.
4—Dual axial-flow turbojet.

**9148.** Name the energy release cycle that takes place in a turbine engine.

1—Otto cycle.
2—Brayton cycle.
3—Autocycle.
4—Bernoulli's cycle.

**9149.** Why is 36,000 feet a significant altitude for the operation of turbojet engines?

1—It is difficult to maintain ignition in the rarified air above this altitude.
2—The temperature of the atmosphere drops rapidly above this altitude resulting in poor ignition and fuel burn.
3—Whenever possible, flight should be made above this altitude to take advantage of this thinner air.
4—Flight above this altitude becomes much less efficient without the assistance of reduced outside air temperature increasing density.

**9150.** What determines the maximum RPM limitation applied to turbojet engines?

1—Compressor blade tip speeds.
2—Rotational speed limited by centrifugal force applied to the turbine blades.
3—The rotational speed at which lubricants begin to break down.
4—Frictional heat generated by compressor speeds which can range upward of 50,000 RPM.

**9151.** On most turbojet aircraft ram recovery is said to occur above a speed of

1—85 knots.
2—140 knots.
3—160 knots.
4—180 knots.

**9152.** What is the primary purpose of a turbojet engine compressor?

1—Supply air for all functions requiring compressed air.
2—Increase the pressure of the mass of air entering the engine inlet.
3—Drive the engine accessories.
4—Turn the shaft for turbofan or turboprop operations.

**9153.** Where is bleed air extracted to supply heated air for inlet anti-icing?

1—Turbine section.
2—Burner section.
3—Compressor section.
4—Exhaust section.

**9154.** Which are some advantages of a centrifugal flow compressor?

1—Low weight and large frontal area.
2—More than two stages and low pressure rise per stage.
3—Low starting power requirements and good efficiency over a wide rotational speed range.
4—Simplicity of manufacture and high starting power requirements.

**9155.** Which are some disadvantages of centrifugal flow compressors?

1—Large energy losses between stages and large frontal area.
2—High weight and high starting power.
3—Complexity in manufacture and relatively high cost.
4—Low pressure rise per stage and a narrow range of rotational speed efficiency.

**9156.** One advantage of an axial-flow compressor is

1—ease of manufacture and low cost.
2—relatively low weight.
3—low starting power requirements.
4—small frontal area.

**9157.** Your aircraft is equipped with a single spool compressor which has a compressor static discharge pressure of 130 PSI. If the ambient pressure is 14.7 PSI, what is the compression ratio?

1—11.3:1.
2—8:8:1.
3—6:6:1.
4—3.3:1.

**9158.** Ambient pressure is 13.4 PSI and the discharge pressure of the last stage of compression is 135 PSI. What is the compression ratio?

1—10:1.
2—9:1.
3—8:1.
4—7:1.

**9159.** Your aircraft is equipped with a turbine engine utilizing a dual-spool compressor. $N_1$ compression ratio is 3:1, and the $N_2$ compression ratio is 5:1. What is the total compression ratio?

1—1.6:1.
2—6:1.
3—8.2:1.
4—15:1.

**9160.** A turbojet engine has a dual-spool compressor with an $N_1$ compression ratio of 4.6:1; and $N_2$ compression ratio of 8.2:1. What is the total compression ratio of this engine?

1—12.8:1.
2—17.8:1.
3—37.7:1.
4—56.0:1.

**9161.** A turbojet engine has a triple-spool compressor with an $N_1$ compression ratio of 3.0:1; $N_2$ compression ratio of 5.2:1; and $N_3$ compression of 9.6:1. What is the total compression ratio of this engine?

1—149:1.
2—62:1.
3—60:1.
4—18:1.

**9162.** A turbojet engine has a triple-spool compressor with an $N_1$ compression ratio of 2.4:1; $N_2$ compression ratio of 4.1:1; and $N_3$ compression of 7.7:1. What is the total compression ratio of this engine?

1—14.2:1.
2—75.8:1.
3—78.2:1.
4—178.0:1.

**9163.** Why are profile compressor blade tips often referred to as "squealer tips?"

1—Because of the high pitched noise they make when contacting a shroud strip during coastdown.
2—Due to the high pitched whine they make when operating at lower compressor speeds.
3—As the blade tips reach Mach 1, or greater, they emit a sound shock wave within the audible range of humans.
4—When you can hear metal-to-metal contact on coastdown, this indicates the blades need inspection for damage.

**9164.** As applies to turbojet engine operations, what is the remedy for an acceleration stall?

1—Increase power to bring engine RPM up to speed with inlet air velocity.
2—Reduce power and allow the inlet air velocity and engine RPM to balance.
3—Increase angle of attack and add power.
4—Reduce angle of attack and add power.

**9165.** Where in the engine is air pressure the highest?

1—In the last stage compressor.
2—At the combustor or burner outlet.
3—In the tailpipe or exhaust sections.
4—In the diffuser.

**9166.** When bleed air is tapped for accessories, it is taken from the

1—air inlet.
2—last stage compressor.
3—diffuser.
4—combustor.

**9167.** At what point in the engine are gases flowing at the highest velocity?

1—Compressor.
2—Turbine stator.
3—Diffuser.
4—Tailpipe.

**9168.** Which type of thrust reverser is stowed in such a position that it forms a part of the exhaust duct?

1—Annular.
2—Can-annular.
3—Cascade.
4—Clamshell.

**9169.** Which engine seldom requires noise suppression?

1—Turbofan.
2—Turbojet.
3—Turboprop.
4—Turbocharged.

**9170.** With application to turbine engine operations, define the commonly used abbreviation, "F.O.D."

1—Forward of Diffuser.
2—Foreign object damage.
3—Forward of Detente.
4—Failed of deterioration.

**9171.** Damage incurred in the gas path of turbine engines from material failure of aircraft or engine parts is called

1—deterioration damage (D.D.).
2—default parts damage (D.P.D.).
3—domestic object damage (D.O.D.).
4—gas path failure (G.P.F.).

**9172.** The basic turbojet engine is divided into two main sections. They are the

1—compressor and turbine.
2—inlet and exhaust.
3—rotor and stator.
4—hot and cold.

**9173.** Turbojet and turbofan engines normally ground idle at

1—12 to 18 percent RPM.
2—20 to 30 percent RPM.
3—40 to 60 percent RPM.
4—75 to 90 percent RPM.

**9174.** As applied to turbojet and turbofan engine ignition systems, the term "high intensity" means that

1—firing time is long compared to other types of engines.
2—a lethal charge is present and special handling is required.
3—the ignition system is measured in Watts rather than Joules.
4—ignition of atomized fuel is a longer cycle than "low intensity" systems.

**9175.** What is the recommended operational cycle of a high voltage, noncontinuous a.c. input system?

1—2 minutes on, 3 minutes off.
2—2 minutes on, 20 minutes off.
3—20 minutes on, 10 minutes off.
4—10 minutes on, 20 minutes off.

**9176.** If an aircraft is equipped with an a.c. continuous ignition system, why are igniter plugs switched from one to the other?

1—To allow for equal amounts of plug service life.
2—Operate one plug while the other is cooling.
3—Prevent exceeding the operating time limit on one plug.
4—To be sure both plugs are operational by continuous cross-check.

**9177.** In which engines would the glow-plug type igniter usually be found?

1—On larger turbojet and turbofan engines, but utilized only in the cruise mode.
2—Engines requiring extremely high start temperatures.
3—Smaller engines with extremely low temperature starting.
4—Any engine with a.c. starter ignition systems.

**9178.** If a generator malfunction is indicated, which is correct?

1—The flight engineer can disconnect the constant speed drive, correct the problem, then reconnect the constant speed drive.
2—The constant speed drive can be disconnected by the flight engineer, but can be reconnected only after landing.
3—Flight engineers can disconnect and reconnect the constant speed drive unit as necessary.
4—Constant speed drive units cannot be disconnected in flight, therefore the engine must be shut down.

**9179.** If the generator is being driven by the constant speed drive, but there is no field excitation from the voltage regulator, the generator will show

1—battery voltage.
2—line voltage.
3—residual voltage.
4—bus voltage.

**9180.** Before a generator can be connected to the tie bus with another generator, it must be synchronized. What does this mean?

1—Voltage must be the same as the voltage at the bus.
2—Frequency must be the same as the frequency at the bus.
3—Hertz readings must be the same as the Hertz at the bus.
4—Both voltage and frequency must be the same as the voltage and frequency at the bus.

**9181.** When synchronizing generators on the a.c. control panel, what does it mean when both synchronizing lights are burning steadily?

1—Generators are not synchronized.
2—Phase rotation between the bus generator and the one to be tied in are opposite.
3—Phase rotation between the generator to be tied in and the bus generator are opposite.
4—Generators are synchronized and the tie breaker can be closed.

**9182.** When synchronizing another generator to the tie bus, what is indicated when both synchronizing lights are out?

1—Both generators are not synchronized and the tie breaker should not be opened.
2—Both generators are synchronized and the tie breaker can be closed.
3—Phase rotation between the generators are opposite.
4—The a.c. control knob should be turned to cause both synchronizer lights to burn continuously.

**9183.** During generator synchronization the two synchronizing lights are flashing alternately. What does this indicate?

1—Phase rotation between the generator and the tie bus matches, but voltage is incorrect.
2—The generators are synchronized and the tie breaker can be closed to connect the generator to the tie bus.
3—Phase rotation between the tie bus generator and the generator to be connected is opposite so the generator must not be connected.
4—Voltage between the tie bus generator matches so the generator may be connected to the tie bus.

**9184.** Circuit breakers that cannot be forced to override an open circuit are called

1—trip-free breakers.
2—push-to-reset breakers.
3—push-pull breakers.
4—toggle-type breakers.

**9185.** Engine pressure ratio is the engine pressure ratio measurement between

1—uncorrected compressor inlet pressure and turbine discharge pressure.
2—compressor inlet total pressure corrected for inlet duct loss and turbine discharge total pressure.
3—compressor outlet total pressure corrected for temperature, and turbine discharge total pressure.
4—turbine discharge pressure and exhaust pressure adjusted for temperatures other than standard.

**9186.** Which is a measure of the speed of the low speed compressor of a two-spool turbine engine?

1—$N_1$.
2—$N_2$.
3—$N_3$.
4—$N_4$.

**9187.** Which indicates the speed of the high speed compressor of a two-spool turbine engine?

1—Pt2.
2—Pt5.
3—$N_1$.
4—$N_2$.

**9188.** After discharging one of the fire bottles into a turbine engine, what indicates the fire has been extinguished?

1—The fire warning bell is silenced.
2—The fire pull switch resets.
3—EGT or TGT gauges do not show a temperature reading.
4—Fire warning light goes out within 30 seconds.

**9189.** Define "stoichiometric mixture."

1—The ideal proportion of 15:1, by weight, for combustion of air and jet fuel.
2—The richest mixture of air and jet fuel which will still burn without danger of rich blowout.
3—The leanest mixture of air and jet fuel which will still burn without danger of lean blowout.
4—The point at which the mixture becomes either too rich, or too lean to support combustion.

**9190.** Regarding thrust specific fuel consumption (TFSC) and fuel consumption in turbine engines, which is correct?

1—TFSC is higher in flight, but actual fuel consumption is only 40 percent of that used on the ground.
2—TFSC is higher in flight, but less actual fuel is needed per pound of thrust to keep thrust at an acceptable level.
3—Fuel consumption and TFSC are equivalent constants which remain the same regardless of altitude.
4—Fuel consumption is less and TFSC is less at each higher altitude due to the rarefied air and lower mass airflow.

**9191.** If the turbine discharge pressure of a dual-spool turbine is measured to be 62.4" Hg and engine inlet pressure is 29.96" Hg, what is the engine pressure ratio?

1—1.04.
2—1.87.
3—2.08.
4—4.16.

**9192.** A two-spool, axial-flow turbine engine has an inlet pressure of 30.32" Hg and a measured turbine discharge pressure of 59.9" Hg. What is the engine pressure ratio of this engine?

1—1.01.
2—1.97.
3—3.63.
4—3.94.

**9193.** When fuel heaters are in operation, what typical operational restrictions may apply?

1—Operate the heater for 10 minutes out of every 30 minutes.
2—Operate continuous when fuel temperature is within 3 to 5° of freezing temperature.
3—Use fuel heat continuous during takeoff and landing.
4—Operate the heater for 1 minute prior to takeoff, then 1 minute every 30 minutes during flight.

**9194.** Which operation restrictions would apply to the use of turbine engine fuel heaters?

1—Do not operate during takeoff, approach to land, or go-arounds.
2—Continuous operation whenever outside air temperatures are within 5° of freezing temperature.
3—Continuous operation whenever the inlet air temperatures are within 3 to 5° of the freezing point of water.
4—Operate continuous during takeoff, approach to land, or go-arounds when fuel temperatures approach within 5° of the freezing point of water.

**9195.** On turbine engines equipped with fuel heaters using bleed air to warm the heater cores, how will engine operation be affected?

1—Oil temperature will drop as fuel temperature rises within the cooler.
2—Engine pressure ratio will drop and oil temperature will rise.
3—Engine pressure ratio and oil temperature will rise as fuel temperature rises within the cooler.
4—Engine pressure ratio and oil temperature will drop as fuel temperature rises within the cooler.

**9196.** What is indicated if the fuel filter bypass light remains illuminated after the fuel heater system cycles on?

1—This is normal operation as the lights cycle on a timer.
2—Filter operation is returning to normal.
3—Ice crystals are still present in suspended form.
4—Suspect solid contamination at the filter rather than icing.

**9197.** What is the usual method of initiating engine anti-icing procedures?

1—Select one engine, then watch the engine parameters stabilize, after which remaining engines are selected in a similar manner.
2—Select anti-icing for all engines during takeoff, climbout, approach and landing whenever outside air temperatures are at or below freezing.
3—Activate anti-icing on all engines and fuel heaters anytime outside air temperatures are at or below freezing and you are in visible moisture.
4—Anytime fuel temperatures are at or below the freezing temperature of water and you are in visible moisture.

**9198.** In what manner will activation of anti-icing procedures be indicated?

1—Illumination of an indicator light and a slight rise in exhaust gas temperature.
2—An indicator light turns on in the cockpit and a slight loss of exhaust gas temperature due to bleed air.
3—An indicator light in the cockpit is extinguished and a slight loss of exhaust gas temperature is noticed.
4—A slight rise in RPM or PERCENT of power, a drop in exhaust gas temperature, and an indicator light illuminates on the annunciator panel.

**9199.** A typical thrust reverser will provide approximately

1—20 to 30 percent reverse thrust.
2—40 to 50 percent reverse thrust.
3—60 to 70 percent reverse thrust.
4—80 to 90 percent reverse thrust.

**9200.** Why is it inadvisable to operate thrust reversers at lower ground speeds?

1—Reingestion of hot gases and compressor stalls.
2—Lack of effectiveness due to slower reactive speeds.
3—The aircraft is now in the effective braking range and reversers are no longer needed.
4—Reversers, neither aerodynamic blockage or mechanical-blockage types, will operate at speeds below 80 knots.

**9201.** The sound level of the average turbojet airliner during takeoff, as heard by persons on the airport, is approximately

1—75 to 80 decibels.
2—85 to 90 decibels.
3—95 to 100 decibels.
4—105 to 110 decibels.

**9202.** When starting a turbine engine, normal lightoff will usually occur

1—within 20 seconds or less.
2—within 30 seconds or less.
3—between 20 and 40 seconds.
4—between 30 and 60 seconds.

**9203.** How long does it take a typical turbine engine starter and turbine combined to bring the engine from rest to idle speed?

1—15 seconds.
2—30 seconds.
3—45 seconds.
4—60 seconds.

**9204.** During the start sequence, if the engine speed stabilizes at or near the starter cutoff speed, and fuel is added in an attempt to accelerate, what may occur?

1—Hung start.
2—Delayed start.
3—Hot start.
4—Self-acceleration.

**9205.** Which starter is used on the majority of turbine powered commercial aircraft?

1—Electric starter-generator.
2—Air turbine starter.
3—Hydraulic APU.
4—Fuel-air combustion starter.

**9206.** On the labels of some synthetic lubricant containers, the term "centistoke" means

1—the oil cannot be used in turbine powered aircraft.
2—the metric viscosity equivalent to Society of Automotive Engineers (SAE) values.
3—the oil should be used in turbojet airplanes only.
4—the volume of the container is metric in value and should be compared for equivalancy to standard measure.

**9207.** Gas turbine engine lubricating oil Type-2 has the desirable characteristic of not requiring preheat until outside air temperatures are less than

1—10°F.
2—20°F.
3—30°F.
4—40°F.

**9208.** Which is an advantage of Type-2 turbine oil over Type-1 turbine oil?

1—It has a lower temperature range.
2—Type-2 oil can be used interchangeably in any turbine engine.
3—Type-2 oil is nontoxic.
4—It will withstand higher operating temperatures.

**9209.** Which is an advantage of Type-1 turbine oil over Type-2 turbine oil?

1—It will better withstand lower temperature ranges.
2—Type-1 oil has a higher detergent quality.
3—It will better withstand higher operating temperatures.
4—Type-1 oil is nontoxic.

**9210.** Which is a desirable characteristic of Type-2 turbine oil?

1—It may not be detrimental to older engines.
2—Has improved anti-coking characteristics.
3—The lowest operating temperature range of all turbine oils.
4—It was designed to be compatible with most older turbine engine installations.

**9211.** While refueling at an airport outside the United States it is determined you require 1,840 gallons of fuel. The fuel supplier utilizes metric measure. How many liters of fuel should you accept?

1—2141.8.
2—6691.7
3—6964.4.
4—8364.6.

**9212.** You determine your fuel requirements are 2,210 gallons of aviation fuel. Your flag airport supplier delivers 8364.8 liters of fuel. Is this correct?

1—No, the correct amount is 2572.4 liters.
2—Yes, 8364.4 liters is correct.
3—No, the correct amount is 10046.6 liters.
4—No, the correct amount is 56178.2 liters.

**9213.** Your flag air carrier turbine aircraft requires an additional fuel load of 12,864 pounds of jet fuel. How many liters of fuel should be delivered?

1—6955.7 liters.
2—7267.2 liters.
3—8115.0 liters.
4—8542.1 liters.

**9214.** Which turbine fuel is blended with gasoline fractions, and has the highest vapor pressure?

1—Kerosene.
2—Jet A.
3—Jet A1.
4—Jet B

**9215.** The basic law we use when transmitting power by a hydraulic system is

1—Pascal's law.
2—Boyle's law.
3—Bernoulli's theorem.
4—Basic law of Archimedes.

**9216.** Which is a provision for blocking a hydraulic line in the event of a serious leak?

1—Shunt valves.
2—Hydraulic fuses.
3—One way valves.
4—Check orifices.

**9217.** How does a pneumatic system differ from a hydraulic system?

1—Pneumatic systems use hydraulic fluid under pressure, where hydraulic systems use pumps.
2—Hydraulic systems use oil as a fluid and pneumatic systems use compressed air as a fluid.
3—The typical hydraulic system is lighter in weight than the typical pneumatic system.
4—The majority of airplanes built in the United States use pneumatic systems rather than hydraulic.

**9218.** In the event of total failure of the hydraulic brake system in a large turbine aircraft, how would braking be accomplished?

1—By directing compressed air or nitrogen into the brake system.
2—Through lockout deboosters bringing additional fluid into the brake system from the accumulators.
3—By mechanical linkage utilizing cables and pulleys.
4—Only through the immediate application of thrust reversers and spoilers.

**9219.** Oxygen for use in flight environments must meet what requirements?

1—Have no more than two milliliters of water per liter of gas.
2—Meet MIL-0-2100 or greater specifications.
3—Be equivalent to, or better than commercial medical oxygen.
4—Be capable of maintaining breathing quality after long term storage.

**9220.** What is meant when a flight instrument contains "bugs?"

1—Some phase of the unit operation is unreliable.
2—The instrument is set up to receive outside stimulus.
3—The instrument is subject to occasional unexplainable failure.
4—Relates to small indicators around the periphery of the dial which indicate selected flight data or speeds.

**9221.** In flight, how can you verify the operation of pitot heat?

1—There are no indications of operation while in flight.
2—The continued and uninterrupted operation of the instruments related to the pitot source are evidence the heat is working.
3—A change in airspeed when the switch is activated indicates a change in air density due to the pitot heat.
4—Observe the ammeter for a change in load when the pitot switch is activated.

**9222.** Comparing the turn and slip indicator with a turn coordinator, which is correct?

1—Turn coordinators respond to both roll and yaw, but turn and slip indicators do not.
2—Turn and slip indicators respond to both roll and yaw, but turn coordinators do not.
3—The turn and slip indicator utilizes a small symbolic airplane for its pictorial.
4—The turn coordinator utilizes a pointer and index marks for its pictorial.

**9223.** Regarding the installation of all electric instruments, which is correct?

1—They must have some type of failure indicator showing a loss of power.
2—Each flight instrument must have a redundant vacuum counterpart.
3—All electric instruments must operate off d.c. current.
4—All electric instruments must operate off a.c. current.

**9224.** Turbine engine fuel flow indicators are mass flow indicators that measure

1—fuel flow in gallons per hour rate of flow on a standard day.
2—the number of gallons flowing into the engine calibrated in gallons per hour adjusted for temperature.
3—the number of pounds per hour of fuel flowing into the engine and calibrated in pounds per hour.
4—gallons per hour flowing through the gauge calibrated for both temperature and altitude.

**9225.** What is meant by the term "wide cut" turbine fuel?

1—May be utilized in either turboprop or turbojet engines.
2—Contains fractions of both gasoline and kerosene.
3—Available world-wide wherever jet fuel is sold.
4—Contains premixed additives to prevent microbial growth and formation of ice crystals.

**9226.** Which are examples of "wide cut" turbine fuels?

1—Jet A and Jet A-1.
2—Jet A-1 and JP-5.
3—Jet B and JP-4.
4—Jet A and JP-4.

**9227.** Select an example of de-icing equipment.

1—Pitot heat.
2—Heated engine inlets.
3—Pneumatic boots.
4—Windshield heat.

**9228.** Anti-icing by directing hot compressor bleed air through ducts in the leading edges of the wings is called

1—conditional anti-icing.
2—thermal anti-icing.
3—turbine anti-icing.
4—Ducted air anti-icing.

**9229.** When more than two wheels are attached to one landing gear strut, the attaching mechanism is referred to as a

1—tricycle gear struts.
2—tandem axle.
3—bogie.
4—truck axle.

**9230.** How is nosewheel steering usually accomplished for taxiing most large aircraft?

1—Through a combination of rudder and brake application.
2—Use of differential power to augment differential braking.
3—Use of differential power in conjunction with independent rudder and brake application.
4—Through the use of an independent cockpit steering wheel or lever separate from the rudder and brakes.

**9231.** A flight engineer is informed that one of the main gear tires has deflated as a result of a thermal fuse melt. What does this mean?

1—A fusible metal plug installed in the aircraft wheel has melted due to high tire temperature causing the tire to deflate.
2—The valve core in the tire is made of a low melting point fusible rubber that has melted allowing the tire to deflate before becoming damaged.
3—Brake fluid has overheated within the wheel causing a hydraulic fuse to activate to prevent blowing the wheel.
4—Wheel temperature has become high enough to cause boiling of fluid in the brake lines causing a thermal valve to open and allow the tire to deflate.

**9232.** One reason to properly preflight wheels and tires prior to takeoff is that

1—tire failure on landing is the most common and most dangerous tire failure.
2—more tires fail on takeoff than on landing which can be extremely dangerous.
3—you must determine the presence, if any, of reverted rubber signs originating with pivotal turns.
4—it is essential to prevent hydroplaning due to reduced tire pressure lowering the hydroplane speed range.

**9233.** On most large turbojet aircraft, how are the low speed ailerons unlocked for use?

1—By an arming switch on the first officer's panel.
2—Automatically whenever the trailing edge flaps are lowered.
3—Whenever the leading edge slats are extended.
4—Automatically whenever the roll input exceeds 10 degrees.

**9234.** If ground spoilers have been deployed, when can they be raised?

1—At any time through operation of the control lever.
2—Not until trailing edge flaps have been raised.
3—Only when the weight of the airplane is on the landing gear.
4—Anytime after reaching antiskid lockout speed.

**9235.** Large transport-type airplanes are equipped with yaw dampers to counteract Dutch roll, and other anomalies. From which instrument does the yaw damper receive its signal to produce a rudder deflection?

1—Turn/bank indicator.
2—Horizontal situation indicator.
3—Artificial horizon.
4—Turn/slip indicator.

**9236.** What type of wing flaps extend out the trailing edge of the wing to nearly full chord before beginning deflection?

1—Fowler flaps.
2—Slotted flaps.
3—Split flap.
4—Krueger flap.

**9237.** What devices alter the shape of the wing leading edge providing added camber for high lift at slow speeds?

1—Split flaps and slats.
2—Fowler flaps and spoilers.
3—Krueger flaps and slats.
4—Slotted flaps and spoilers.

**9238.** Concerning operation of the aircraft antiskid system, which is correct?

1—The captain, or first officer at the direction of the captain, must deactivate the antiskid for maneuvering and parking.
2—The antiskid system automatically deactivates below 20 miles per hour to allow full brake control.
3—Antiskid systems do not have a built-in test function.
4—If the antiskid system is manually deactivated, the captain will have steering, but no braking capability.

**9239.** The gasper system provides

1—warm or cold air as needed through overhead ventilating air outlets.
2—warm air only through floor mounted ducts.
3—cold air only through floor mounted ducts.
4—cold air only through overhead ventilating air outlets.

**9240.** Which cabin air conditioning system utilizes a refrigerant to carry away cabin heat?

1—Vapor cycle air conditioning.
2—Air cycle system air conditioning.
3—Evaporative blower system.
4—Cold pack gasper system.

**9241.** Hot compressor bleed air is used to provide cooling air for the cabin through the

1—high pressure evaporative air conditioner.
2—vapor-cycle air conditioning system.
3—refrigeration system air conditioner.
4—air cycle system.

**9242.** Which aircraft cabin cooling system is referred to as the "bootstrap" system?

1—Vapor cycle air conditioning system.
2—Air cycle system.
3—Evaporative refrigerant system.
4—High pressure evaporative system.

**9243.** Which is correct with regard to leaking refrigerant R-12?

1—The liquid can be lethal if breathed.
2—Refrigerant R-12 is nontoxic to the skin.
3—Refrigerant R-12 can change to deadly phosgene gas if subjected to an open flame.
4—The leaking liquid can change to nitric acid if it comes in contact with water in the system.

**9244.** Which would indicate that an electrically powered instrument has failed?

1—A sudden change in ammeter reading.
2—Fluctuations in the instrument readings.
3—No indications at all.
4—A failure indicator as required on all electrical instruments.

**9245.** Select the correct statement concerning the ground operation of airborne weather radar systems.

1—The ON position should never be selected while on the ground.
2—It must not be turned to the ON position if people or buildings are within 100 yards of the antenna sweep.
3—When on the ground, the unit must be operated in the STANDBY position only.
4—Observing the reflective ground clutter is a valuable means of determining operational effectiveness.

**9246.** Pulses of energy transmitted from the airborne radar when operated on the ground are

1—strong enough to seriously injure a nearby person.
2—harmless to people, but can interfere with the operation of precision electronic landing systems.
3—harmless to people, but reflection off nearby buildings can damage the unit.
4—insignificant when mixed with the pulses of other radar units operating in the area.

**9247.** When the aircraft is at rest, what should an accelerometer read?

1—Zero.
2—One G negative.
3—One G positive.
4—The G factor of the most recent landing.

**9248.** Fuel systems are designed to be free from vapor lock until fuel temperatures exceed

1—90°F.
2—100°F.
3—110°F.
4—120°F.

**9249.** What is an integral fuel tank?

1—Any fuel tank located inside the fuselage.
2—Fuel tanks other than tip tanks.
3—Any fuel tank equipped with a bladder and located in the wing.
4—A part of the wing structure itself that has been sealed off to carry fuel.

**9250.** Within the fuel dump system, what is the function of the fuel dump limit valve?

1—Shut off the flow if the pressure drops below that required for proper engine operation.
2—Maintains a constant dump rate of 2,300 pounds of fuel per minute.
3—Increases or decreases the fuel dump flow in accordance with the set flow rate.
4—Prevents dumping more than one tank at a time.

**9251.** What prevents fuel dumping operations from exceeding the preset dump shutoff level?

1—An annunciator warning on the flight engineer panel.
2—The fuel dump limit valve.
3—Automatic activation of the engine shutoff valve when fuel pressure falls 10 pounds below normal.
4—Automatic activation of the boost pump bypass valve.

**9252.** In addition to anti-icing functions, why are windshields heated?

1—Clarity of the vinyl is improved with the windshield heat on.
2—Navigation instruments are calibrated with the windshield heat on.
3—To strengthen against bird strikes.
4—To prevent cracking due to temperature changes.

**9253.** When the rain repellent push-button switch is depressed, the fluid will flow

1—as long as the button depressed.
2—for less than a second, then automatically shut off.
3—cycle in 2 second intervals for 30 seconds, then shut off.
4—simultaneous with windshield wiper operation.

**9254.** Which is correct when applying liquid rain repellent?

1—Begin application as soon as rain begins, to form a barrier between the rain and the windshield.
2—Apply rain-repellent first, then activate the windshield wipers to spread the repellent.
3—The number of times the repellent button is depressed is determined by the intensity of the rain.
4—The repellent should first be sprayed onto a dry windshield to "season" the vinyl.

**9255.** What type of fire detection system is used in most turbine engine installations?

1—Pressure-type sensor responder.
2—Thermal switch detectors.
3—Thermocouple-type detectors.
4—Continuous loop Fenwal/Kidde system.

**9256.** The shroud around the auxiliary power unit (APU) will usually contain what type of fire detection system?

1—Thermal switch detectors.
2—Thermocouple-type detectors.
3—Pressure-type sensor responder.
4—Continuous loop Lindberg detector system.

**9257.** The optical smoke detectors on the flight engineer panel correspond to

1—Lindberg smoke detectors installed in the cargo holds.
2—translucent spotter tubes providing a view of the cargo holds.
3—closed circuit mini-cam installations in the cargo hold.
4—light beam responses to cargo hold air samples.

**9258.** How can the flight engineer determine if the optical smoke indicators are on, or off?

1—By observing small lights inside the windows.
2—A small amber light above the optical window is on when the detector is on.
3—A small green light above the optical window is off when the detection system is off.
4—The detectors are on continuously whenever there is a.c. power to the main bus.

**9259.** Name in order, the sequence of events in the energy release cycle of a gas turbine engine?

1—Intake, ignition, power, compression, exhaust.
2—Intake, compression, ignition, power, exhaust.
3—Intake, ignition, compression, power, exhaust.
4—Intake, ignition, power, compression, exhaust.

**9260.** When ambient temperature exceeds the flat rating of the engine, which is correct?

1—Exhaust pressure ratio will be excessive.
2—100 percent thrust can no longer be obtained.
3—An overtemp condition is no longer possible.
4—The flat shape of the full thrust curve will change relative to $N_2$.

**9261.** When equipped with water injection, what fluid is most commonly used?

1—Water and ethyl-alcohol mix.
2—Water and methyl-alcohol mix.
3—Demineralized or distilled water.
4—Water treated with anti-microbial additives.

**9262.** Considering the thrust augmentation factor, which injection liquid will produce the greatest cooling effect?

1—Pure water.
2—Ethyl alcohol.
3—Methyl alcohol.
4—Water and alcohol combined.

**9263.** Flat rating a turbine engine will

1—reduce engine service life.
2—produce a constant rated thrust over a narrow range of ambient temperatures.
3—allow higher operating temperatures for greater thrust.
4—prolong engine service life.

**9264.** In a typical installation, how is the water injection pump driven?

1—Electrically powered high volume water pumps.
2—Gear driven high volume water pumps.
3—Hydraulic discharge over reduction gearing.
4—Compressor bleed air through an air driven pump.

**9265.** Due to frequent takeoffs and landings, the liquid injection in turboprop airplanes usually consists of

1—distilled water.
2—demineralized water.
3—methyl or ethyl alcohol.
4—water-alcohol mixture.

**9266.** If a large turbine airplane has a mass airflow of 160 pounds per minute, a liquid/air ratio of 5:1, and a water injection rate of 850 pounds per minute; how long would it take to use up 300 gallons of water?

1—One minute.
2—Two minutes.
3—Three minutes.
4—Four minutes.

**9267.** When the cockpit mounted water-injection switch is armed, how is the injection system activated?

1—Through a time cycling flow valve allowing liquid to be injected every few seconds through the diffuser.
2—Power to the fuel control microswitch which is depressed when the power lever reaches takeoff power.
3—Liquid flow is regulated through EPR synsors which automatically begin liquid flow at preset values.
4—Pressure sensors connected to the fuel controller that pressurize the manifolds with water pressure of 200 to 300 psig.

**9268.** Concerning the operation of a water-injection system, which is correct when ambient temperatures are below 40°F.?

1—Only the compressor injection should be activated.
2—There is usually adequate thrust for any gross takeoff weight without the use of liquid injection.
3—Diffuser injection should not be used due to icing probabilities.
4—Only ethylene-glycol solutions should be used.

**9269.** Generally, flat rating a turbine engine enables the engine to

1—increase thrust without increasing engine presure ratio.
2—produce a constant rate of thrust over a wide range of ambient temperatures.
3—decrease mass flow without increasing turbine temperature.
4—decrease engine pressure ratio without increasing thrust.

**9270.** Manifold dumping is best described as a procedure which

1—controls gas pressure within the manifold by a spring loaded gate that opens on engine shutdown.
2—allows all fuel tanks to be jettisoned at once through a common manifold.
3—sharply cuts off combustion and also prevents fuel from boiling in the lines.
4—drains fuel from the combustor when the engine is shut down.

**9271.** When the power lever is opened for a turbine engine start, how is the dump valve affected?

1—A pressure signal is activated at the fuel control that closes the dump port and opens the manifolds.
2—A pressure signal is deactivated on the fuel control allowing the dump port to open and manifolds to close.
3—The dump valve closes with gas pressure after start.
4—The dump valve is spring loaded and is not affected by the fuel controller.

**9272.** What is the purpose of the dump, or sometimes called "drip valve" that is incorporated in the low point of the fuel manifolds?

1—Drain raw fuel from the combustors to prevent after-fires.
2—Dump excess fuel which has accumulated in the fuel nozzles.
3—Drain any fuel accumulations in the tailpipe after shutdown.
4—Drain the fuel manifold after shutdown.

**9273.** How is the fuel pressurizing and dump valve activated?

1—By means of a dump switch located on the flight engineer panel.
2—The cessation of engine gas pressure flow at shutdown.
3—A spring loaded valve activated below specified engine pressure ratios.
4—Through the loss of a pressure signal when the fuel lever is moved to the off position.

**9274.** Which best describes the operation of the combustor drain valve as found in a turbine engine?

1—The valve is held in the open position by gas pressure when the engine is operating.
2—A spring loaded valve holds the drain closed when the engine is not in operation.
3—The valve is closed by operating gas pressure then held open by spring pressure when not in operation.
4—The combustor drain valve is opened and closed by means of a microswitch on the fuel controller which receives signals according to power lever position.

**9275.** Regarding ram recovery, which is correct?

1—Some ram recovery occurs during ground operations as well as high speed flight.
2—Increased pressure at the inlet allows the engine to create thrust with less expenditure of fuel.
3—Ram recovery is the difference between what the inlet duct can accept, and the amount of air available.
4—Ram recovery can occur at any speed depending on the shape and size of the inlet ducts.

**9276.** Which part of a turbine engine is usually identified as station one?

1—Low pressure compressor.
2—Fan discharge.
3—Divergent subsonic section.
4—Flight inlet duct.

**9277.** What design of inlet duct is usually found on aircraft that generally fly below ram-recovery speed?

1—Bellmouth inlet.
2—Convergent-divergent.
3—Diffuser-type inlet.
4—Convergent subsonic inlet.

**9278.** On large turbine engines, when are inlet icing conditions the most prevalent?

1—During ground operations at high engine speeds.
2—At high altitudes during reduced power descents.
3—Low altitude flight operations in high humidity and ambient temperatures below 40°F.
4—Anytime the ambient temperatures are below 40°F.

**9279.** Some older model turbojet engines have small tabs fitted to the jet nozzle which change the effective open area. These small tabs are called

1—mice.
2—ground adjustable differential performance tabs.
3—rats.
4—Mach adjusters.

**9280.** Which tail pipe (exhaust duct) design is most commonly found on subsonic turbojet airplanes?

1—Convergent-divergent.
2—Divergent.
3—Convergent.
4—Subsonic-divergent.

**9281.** When a turbojet airplane is equipped with a thrust augmentor, it is said to have

1—cascade turning vane thrust reversers.
2—a divergent supersonic duct.
3—a C-D tailpipe or afterburner.
4—clamshell thrust reversers.

**9282.** Where should the propeller control be positioned when starting a turboprop engine that is not equipped with a free-turbine driving the propeller?

1—Any position forward of feather.
2—Feather position.
3—High pitch.
4—Low pitch.

**9283.** During engine start with an air turbine starter, if the starter clutch does not release upon reaching design speed, what will happen?

1—To prevent major damage, the clutch drive shaft will shear at a predetermined torque force.
2—At approximately 30 percent engine speed the pawls of the overrunning clutch will re-engage causing the clutch to shear off.
3—The starter will quickly reach burst speed.
4—At a present engine speed, the clutch will be disengaged by centrifugal force acting on the pawls.

**9284.** During the coastdown of an air turbine starter a clicking sound is frequently heard. What does this indicate?

1—Impending failure of the sprag clutch ratchet (clutch failure).
2—Not a malfunction, but rather the result of the pawls riding on the clutch ratchet.
3—Failure of the clutch to fully disconnect from the engine.
4—The driveshaft housing is contacting the gearbox and should be inspected by maintenance.

**9285.** If you experience a false or hung start and the starter-generator appears alright, what is the probable cause?

1—Low voltage.
2—Undercurrent relay failure.
3—Insufficient bleed air.
4—Failed starter solenoid.

**9286.** An engine oil check reveals the turbine oil is a dark brown color, but with little or no contaminants. What does this indicate?

1—This is normal for engines of average time in service.
2—Turbine oil is dark brown in color to distinguish it from reciprocating engine oil.
3—The oil and filters are overdue for changing.
4—This indicates a possible serious engine overheat and should be reported.

**9287.** What is the function of an airplane's propeller?

1—Convert horsepower to thrust.
2—Provide lifting action.
3—Convert thrust to lift.
4—Provide a kinetic source of engine power.

**9288.** When an airplane is designed so that the propeller disc comes no closer than one inch to the airframe, this is known as

1—fuselage gap.
2—radial clearance.
3—blade track.
4—blade station.

**9289.** FAR's require that if a propeller can be feathered, there must be

1—some means of unfeathering it in flight.
2—some means of preventing it from unfeathering in flight.
3—a separate feathering control located somewhere other than the prop control itself.
4—a clutch to prevent windmilling, should it occur.

**9290.** Airplanes of current manufacture are equipped with propeller governors which, if they should fail, will not allow static RPM in excess of

1—77 percent of rated RPM.
2—87 percent of rated RPM.
3—103 percent of rated RPM.
4—125 percent of rated RPM.

**9291.** What is the pitch distribution of a propeller?

1—The pattern of pressure changes over the face of the blades.
2—Gradual twist in the propeller blade from shank to tip.
3—The distance, in inches, a propeller section will move forward in one revolution.
4—Reference position on a propeller blade that is a specified distance from the center of the hub.

**9292.** When a propeller is feathered, its blades are rotated so they present their

1—leading edge toward the direction of rotation.
2—back to the relative wind.
3—trailing edge forward to prevent unwanted rotation.
4—leading edge to the wind.

**9293.** During preflight, a deep knick is observed at propeller blade station 42. If the propeller is constructed of either metal or composite materials, where on the propeller will the knick be found?

1—At a reference position measured 42" out from the center of the hub.
2—On the blade face at the 42 degree arc.
3—On the blade face at the 42 degree angle of attack.
4—At a reference position measured 42" inboard from the blade tip.

**9294.** During ground operations, if the governor of a constant-speed propeller system fails while in the low blade angle (high RPM) setting, what maximum static RPM will be allowed by the system if rated RPM is 2,900?

1—2,987 RPM.
2—2,900 RPM.
3—2,175 RPM.
4—1,740 RPM.

**9295.** As installed on turboprop aircraft of current manufacture, and large reciprocating engine powered aircraft, which identifies a propeller control?

1—E and color coded blue.
2—D and color coded red.
3—C and color coded blue.
4—A and color coded black.

**9296.** Which control knob would you select as the mixture control?

1—C.
2—E.
3—A.
4—B.

**9297.** The most effective angle of attack for an airplane propeller is between

1—2 and 4 degrees.
2—6 and 8 degrees.
3—10 and 12 degrees.
4—14 and 16 degrees.

**9298.** The force causing the greatest stress upon an operating propeller is

1—thrust bending force.
2—torque bending force.
3—centrifugal force.
4—aerodynamic twisting force.

**9299.** The force which attempts to bend rotating propeller blades forward at the tips is known as

1—torque bending force.
2—thrust bending force.
3—centrifugal force.
4—centrifugal twisting moment.

**9300.** A propeller is subject to forces which attempt to bend the propeller blades back in a direction opposite the direction of rotation. This is identified as

1—torque bending.
2—aerodynamic twisting.
3—centrifugal twisting.
4—thrust bending.

**9301.** In some propeller designs, what aerodynamic force is used to help feather the propeller?

1—Centrifugal twisting.
2—Torque bending.
3—Thrust bending.
4—Aerodynamic twisting.

**9302.** Which force, when acting upon an operating propeller, is greater than aerodynamic twisting, and at operational RPM is used in some designs to decrease blade angles?

1—Torque bending.
2—Centrifugal force.
3—Pitch distribution.
4—Centrifugal twisting.

**9303.** In piston powered airplanes, mechanical vibrations are more destructive in their effect on propellers than aerodynamic vibration. What is the main cause of mechanical vibrations?

1—Propeller out of balance.
2—Power pulses in the piston engine.
3—Propeller out of track.
4—Aerodynamic force vibrations transmitted to the propeller hub.

**9304.** The most critical location for propeller stress concentrations is

1—the junction of the propeller blade and the hub.
2—the blade tip.
3—at various blade locations, according to design.
4—about 6 inches in from the blade tip.

**9305.** Some powerplant/propeller combinations are sensitive to certain power/RPM settings. Regarding these critical ranges, which is correct?

1—The range is marked by a red line on the tachometer and should be passed through to higher or lower settings.
2—A blue line on the tachometer marks the range and it should never be operated within.
3—This range is only critical if operated in for long periods of time and only with cumulative affects.
4—These ranges produce vibrations which are disturbing, but are not detrimental to engine operations.

**9306.** The difference between propeller effective pitch and geometric pitch is called

1—theoretical pitch.
2—pitch efficiency.
3—aerodynamic track.
4—slippage.

**9307.** When starting an engine equipped with a Hamilton-Standard counterweight propeller, why is the start initiated with a high blade angle setting?

1—To direct oil to the propeller hub for gear protection.
2—Reduce air loads on the starter.
3—Direct oil to the governor for propeller speed control.
4—To provide more oil to the engine bearings.

**9308.** Why is a counterweight propeller shut down with the blade in the high angle position?

1—Prevents congealing of oil in the cylinder.
2—Directs oil to the engine bearings for better protection at shutdown.
3—Enables a correct engine oil level reading.
4—Purge the governor in preparation for the next start.

**9309.** Which is a benefit of placing a counterweight propeller in the high blade angle at shutdown?

1—Covers the piston surfaces with oil to protect from dirt and corrosion.
2—Keeps oil in the dome to prevent evacuation of the oil during start-up.
3—Charges the cylinder with oil in preparation for the next start-up.
4—Clears the piston surfaces of oil which could accumulate dirt.

**9310.** When starting an engine equipped with a counterweight propeller, when is the propeller shifted to the low blade angle position?

1—Immediately prior to start-up.
2—Immediately after start-up.
3—As soon as oil pressure comes up and stabilizes.
4—When engine oil temperature and pressure reach their desired values.

**9311.** Moving the propeller control forward will have what effect when equipped with a Hamilton-Standard governor?

1—Compression on the speeder spring is reduced tilting the flyweights outward, increasing RPM.
2—Pressure on the speeder spring is increased causing the flyweights to tilt outward, increasing RPM.
3—The speeder spring is compressed, tilting the flyweights inward, with resultant increase in RPM.
4—The speeder spring is compressed, tilting the flyweights inward, causing a decrease in RPM.

**9312.** Decreasing RPM, when equipped with a Hamilton-Standard propeller governor, is accomplished by

1—moving the cockpit control aft changes pressures on the speeder spring and flyweights, lowering the pilot valve.
2—pressure changes to the speeder spring and flyweights, resulting in the raising of the pilot valve.
3—increasing the centrifugal force on the flyweights.
4—tilting the flyweights inward.

**9313.** By what means is the RPM stabilized by the Hamilton-Standard governor?

1—The effect of centrifugal force on the flyweights returning the pilot valve to neutral.
2—The effect of centrifugal force on the flyweights holding the pilot valve in the desired speed position.
3—Pressure from the speeder spring holding the pilot valve in the desired RPM position.
4—Flyweight rotation holding the speeder spring in equilibrium at the desired RPM setting.

**9314.** Whenever the governor flyweights tilt outward and the pilot valve is raised, the governor is said to be in an

1—underspeed condition.
2—onspeed condition.
3—overspeed condition.
4—equilibrium.

**9315.** If the governor flyweights tilt inward and the pilot valve is lowered, what condition will result?

1—Underspeed.
2—Overspeed.
3—Onspeed.
4—Equilibrium.

**9316.** When the RPM is the same as the governor setting is calling for, the governor is then in its

1—overspeed condition.
2—underspeed condition.
3—command ready condition.
4—onspeed condition.

**9317.** If the aircraft is placed in a dive from cruising flight, how will the governor and propeller be affected?

1—An underspeed condition will result and the governor will call for a decrease in blade angle.
2—An overspeed condition will result and the governor will call for an increase in blade angle
3—No change will be effected since the governor had previously established the desired propeller speed.
4—Flyweights will tilt inward and the pilot valve will be lowered, causing an increase in blade angle.

**9318.** While in straight and level cruise flight, an increase in throttle setting will

1—cue the governor to decrease blade angle to prevent an RPM increase.
2—not have any effect on the governor or propeller since the propeller is controlled separately from the throttle.
3—cause the governor to increase the blade angle to prevent an increase in RPM.
4—cause the propeller blades to decrease angle of attack to maintain the preset governor speed.

**9319.** With regard to manifold pressure, which is correct?

1—A change in propeller RPM setting will not affect the manifold pressure.
2—A change in manifold pressure will result in a change of propeller RPM.
3—Anytime the RPM is adjusted, the manifold pressure will change.
4—Only the throttle governs manifold pressure settings.

**9320.** Which is correct regarding the throttle or power lever movement on horsepower output?

1—If the throttle or power lever is not moved, the horsepower output does not change.
2—Horsepower is determined by propeller setting only.
3—Changes in throttle or power lever only do not change horsepower, unless a corresponding propeller change is also made.
4—Horsepower is a function of density altitude and manifold pressure and does not include the throttle.

**9321.** Counterweight propellers of the steel hub design decrease blade angle

1—through centrifugal force on the hub counterweights.
2—by using engine oil pressure.
3—using a combination of speeder springs and flyweights.
4—using a combination of speeder springs and pilot valves.

**9322.** How is the blade angle of a steel hub constant speed propeller increased?

1—Centrifugal force on the counterweights.
2—Engine oil pressure metered into the hub.
3—Centrifugal twisting moments with limit stops.
4—A combination of engine oil pressure and centrifugal twisting moments limited by the oil pressure.

**9323.** Following engine failure or stoppage, what is the primary purpose of feathering the propeller?

1—Prevent excessive wear to the propeller gears.
2—Evacuate all the oil from the dome to make start-up easier and more reliable.
3—Prevent the propeller from turning the engine which is no longer receiving lubrication.
4—Reduce drag created by a windmilling propeller.

**9324.** Concerning propeller feathering function, which is correct?

1—Feathering functions are part of the constant-speed governing operations.
2—Only constant-speed propellers are featherable.
3—Even though the propeller is feathered, the engine may still continue to rotate.
4—Feathering operations are independent of, and can override constant-speed operations at any time.

**9325.** An unfeathering accumulator is

1—of the ball type only.
2—of the cylinder type only.
3—unusable when the engine is running.
4—available as either the ball or cylinder type.

**9326.** The term, "hydromatic" propeller indicates

1—this is a water injection equipped engine.
2—pneumatic pressure is the primary source of operation.
3—this type of propeller is found only on aircraft of less than 12,500 pounds gross landing weight.
4—the principle operating forces are oil pressure.

**9327.** The hydromatic governor contains a high-pressure transfer valve which is used to

1—provide the constant speed functions.
2—perform the feathering and unfeathering operations.
3—provide a back up system in the event of engine oil pressure failure.
4—block out the constant-speed mechanism when the propeller is feathered and unfeathered.

**9328.** When the feathering system of a hydromatic propeller is actuated, from where does the feathering pump take its oil?

1—Self-contained oil sump.
2—Utilizes oil dome reservoir oil.
3—A separate accumulator.
4—The engine oil supply tank.

**9329.** Which type propeller does not use any springs or counterweights for operation?

1—hydromatic propeller.
2—Steel hub propeller.
3—Two position propeller.
4—Aeromatic propeller.

**9330.** In an overspeed condition of a hydromatic propeller, how does the pilot valve in the governor move to compensate?

1—The pilot valve raises, allowing oil to flow to the inboard side of the propeller piston.
2—The pilot valve raises, allowing oil to flow to the outboard side of the propeller piston.
3—The pilot valve lowers, allowing oil to flow into the dome.
4—The pilot valve remains stationary.

**9331.** During feather operations involving a hydromatic propeller, when does the pressure cutout switch break the circuit to the feather button?

1—When the pressure reaches 650 PSI.
2—As soon as the feather button is released.
3—Immediately, as the rotating cam contacts the high pitch stop.
4—As soon as dome pressure equals engine oil pressure.

**9332.** For hydromatic propeller feathering operations, where is the pressure cutout switch located?

1—On the high pitch stop.
2—On the low pitch stop.
3—On the flight engineer panel.
4—Located on the side of the propeller governor.

**9333.** With the engine stopped, the propeller in feather, and all oil pressures dropped to zero, what holds the blades of a hydromatic propeller in their full-feather position?

1—Oil trapped in the propeller dome.
2—Feathering accumulator.
3—Aerodynamic forces.
4—The meshing of propeller gears and piston.

**9334.** What initial action is taken to unfeather a hydromatic propeller?

1—Turn over the engine with the starter to build up oil pressure, then move the propeller control forward.
2—Place the aircraft in a shallow dive to start the propeller windmilling, then initiate an engine start.
3—Hold the feather button in until the propeller starts windmilling, then release for restart.
4—Hold the feather button to the unfeather position until governor pressure reaches 750 pounds, then release.

**9335.** The hydromatic propeller is totally lubricated by

1—high pressure grease through "zerk" fittings.
2—an independent lubrication system within the dome.
3—operating oil.
4—oil-less bushings and self-lubricated sealed bearings.

**9336.** If a hydromatic propeller fails to respond to the cockpit propeller control lever, but can be feathered and unfeathered, the cause is most likely a

1—broken throttle or power lever operating cable.
2—failure of the governor or governor control system.
3—failed seal in the propeller dome.
4—broken oil line from the engine to the propeller.

**9337.** Which is a major disadvantage of propeller reversing system?

1—Not as effective as judicious brake application.
2—Reduced engine cooling.
3—May not be used on icy or slick runways.
4—Places an excessive strain on landing gear struts.

**9338.** When a propeller goes into reverse, the blades rotate below the low blade angle and into a

1—flat blade angle of zero degrees pitch.
2—negative angle of about -15 degrees.
3—negative angle of about -90 degrees (reverse feather).
4—negative angle that is variable with the propeller control.

**9339.** How is the amount of reverse propeller thrust controlled?

1—The farther aft the throttles are moved, the greater the reverse thrust is produced.
2—The farther aft the propeller controls are moved, the greater the reverse thrust produced.
3—Reverse thrust is preset within the fuel control or pressure carburetor.
4—Propeller controls full aft, then throttles are operated as necessary.

**9340.** How are propellers usually prevented from reversing in flight or at high landing speeds?

1—An airspeed sensor switch preventing the reversing mechanism from engaging.
2—Manifold pressure, or engine pressure ratio sensors preventing engagement above certain settings.
3—Aerodynamic forces prevent reversing above certain speeds according to propeller blade design.
4—A squat switch on the landing gear strut.

**9341.** The Alpha mode is best described as

1—the operational range from 65 percent to 95 percent RPM.
2—any flight operation from takeoff to landing.
3—any ground operation at less than 65 percent power.
4—engine operation above 100 percent of system rating.

**9342.** What occurs when the feather valve is moved by the full aft movement of the cockpit speed lever?

1—Oil is directed to the propeller dome and the propeller then reverses.
2—Oil is evacuated from the propeller dome and enters the beta mode.
3—The propeller feathers as oil is released from the propeller.
4—The propeller goes to flight high idle.

**9343.** Ground operations which include start, taxi, and reverse operations are best known as

1—Beta mode.
2—low idle mode.
3—high idle mode.
4—Alpha mode.

**9344.** If a propeller synchronizing system is installed, it can be used for all operations except

1—rough air conditions.
2—instrument meteorological conditions.
3—takeoff and landing.
4—engine out operations.

**9345.** Aircraft equipped with a propeller synchronization system utilize a master engine used to establish the RPM to which other engines adjust. What are the other engines called?

1—Synchro assisted engines.
2—Validated engines.
3—Comparitors.
4—Slave engines.

**9346.** The comparison unit of a propeller synchronization system has a limited range of operation. In order to synchronize, the other engines must be within

1—100 RPM of the master engine.
2—100 RPM of each other.
3—200 RPM of the master engine.
4—200 RPM of the master engine, or 100 RPM of each other.

**9347.** Which is correct regarding the automatic feathering system?

1—The system is operational only when engines are within 200 RPM of each other.
2—It is armed only during takeoff and landing.
3—The system is utilized only during cruise flight.
4—Operation from takeoff, throughout the flight, to landing is normal.

**9348.** What indicates the automatic feathering system is armed?

1—All engines are operating within 100 RPM of each other.
2—An indicator light illuminates on the panel.
3—The ammeter shows a slight increase in load on each engine.
4—Propeller controls move into alignment on the quadrant.

**9349.** Which is an additional method of arming the automatic feathering circuit?

1—The throttles close a switch when advanced to a specific position.
2—A squat switch located on the landing gear strut prevents operation at speeds below $V_{LO}$.
3—A microswitch prevents the system from activating when the throttles are advanced beyond 75 percent power.
4—The circuit is closed when the throttles are set below the 75 percent power setting.

**9350.** By what method does the automatic feathering system sense the loss of an engine?

1—A contact closes whenever one of the engines deviates more than 100 RPM from the others.
2—An exhaust pressure ratio switch is activated below a prescribed setting.
3—Manifold pressure switches determine activation.
4—A torque pressure switch closes a switch whenever power drops below a prescribed level.

**9351.** What prevents autofeathering when only a momentary interruption in power occurs?

1—Sensor switches are set low enough to allow for all but the most severe power losses.
2—A feather override switch on the panel is used to prevent accidental autofeather.
3—A time delay built into the circuit establishes about a 2 second buffer.
4—Resumption of power automatically cancels the autofeather input.

**9352.** What prevents more than one engine autofeathering at a time?

1—A blocking relay built into the system.
2—A fuse between the master switch and the throttle.
3—Nothing, the system is designed to provide continued protection.
4—The pilot override system on the captain's panel.

**9353.** Which cockpit instrument monitors the most critical turbine engine parameter?

1—Engine pressure ratio.
2—Tachometer.
3—Oil pressure.
4—Exhaust temperature.

**9354.** On which engine is the tachometer not a measure of thrust?

1—EPR rated engines.
2—Centrifugal flow engines.
3—Axial flow engines.
4—Fan engines.

**9355.** If 7,000 pounds of cargo is added to an average location of station 1170.0, what is the new CG position relative to MAC?

Aircraft weight..... 155,000 lb
CG position..... 24.5% MAC
Length of MAC..... Sta. 860.2 to 1040.9

1—25.4 percent.
2—26.7 percent.
3—30.8 percent.
4—31.6 percent.

**9356.** Before takeoff, 2,250 pounds of cargo is moved from the forward to the aft compartment. What is the new CG?

Takeoff weight..... 165,000 lb
CG..... 20.7% MAC
MAC..... 860.2" - 1040.9"
Compartment locations:
  Fwd..... 582"
  Aft..... 1028"

1—22.5 percent of MAC.
2—24.1 percent of MAC.
3—24.7 percent of MAC.
4—25.3 percent of MAC.

**9357.** What is the maximum payload under these conditions?

Basic operating weight..... 101,500 lb
Max. zero fuel weight..... 138,000 lb
Max. landing weight..... 142,500 lb
Max. takeoff weight..... 184,200 lb
Fuel tank load..... 52,000 lb
Estimated fuel burn en route..... 45,500 lb

1—27,700 pounds.
2—30,700 pounds.
3—34,200 pounds.
4—36,500 pounds.

**9358.** A cargo aircraft loaded to a maximum takeoff gross weight of 150,000 pounds is tail heavy. How many boxes weighing 150 pounds each must be moved from station 1200 to station 700 in order to move the CG forward 3 inches?

1—3 boxes.
2—6 boxes.
3—9 boxes.
4—12 boxes.

**9359.** Which aircraft area contains a fire-detection system and is also protected by a fixed fire-extinguishing system?

1—Engine nacelle.
2—Lower electrical compartment.
3—Engine hot section and wheel well.
4—Wheel well.

**9360.** Which area contains a fire, or overheat detection system, but is not protected by a fire-extinguishing system?

1—Wheel well.
2—Engine strut.
3—APU compartment.
4—Lower cargo compartment.

**9361.** What is the function of a pack valve?

1—Mix hot air, cold air, and cool air.
2—Control operation of the pack cooling fan.
3—Control output of the air cycle machine.
4—Admit bleed air to the air conditioning system.

**9362.** Which component gives an indication of the rate of change in cabin altitude and what unit of measurement is used?

1—Pressure controller/PSI.
2—Cabin vertical-velocity indicator/feet per minute.
3—Cabin vertical-velocity indicator/PSI.
4—Cabin altitude indicator/inches of mercury.

**9363.** The function of the cabin pressure relief valve is to

1—limit cabin differential pressure to a maximum of 1.5 PSI while on the ground.
2—prevent exceeding an 8,000 foot cabin altitude.
3—prevent external atmospheric pressure from exceeding internal cabin pressure.
4—limit cabin differential pressure to the design maximum while in flight.

**9364.** The function of the cabin negative pressure relief valve is to prevent

1—exceeding .125 PSI differential pressure when on the ground.
2—the pressure differential between the main cabin and the lower cargo compartments.
3—landing with a positive cabin pressure.
4—atmospheric pressure from exceeding cabin pressure.

**9365.** During pressurized flight, how can you increase the rate of smoke removal?

1—Increase the cabin altitude.
2—Increase the cabin differential pressure.
3—Close the cabin sidewall vents.
4—Open the cabin sidewall vents.

**9366.** An intermittent warning horn during normal cruise flight could be an indication that

1—$V_{MO}/M_{MO}$ speed has been reached.
2—aircraft altitude is 200 feet above or below the assigned cruise altitude.
3—cabin differential pressure limits have been exceeded.
4—cabin altitude limit has been exceeded.

**9367.** Which is a normal source of heat for the air conditioning system?

1—Engine turbine section heat exchanger.
2—Electric radiant ceiling panels.
3—Engine bleed air.
4—Jet pump heat.

**9368.** What method is commonly used to prevent pressurization pressure bumps during takeoff?

1—Set the cabin rate controller to FULL DECREASE.
2—Pre-pressurize the aircraft by approximately one-eighth PSI.
3—Set the cabin altitude selector 2,000 feet above the planned flight altitude.
4—Set 29.92" Hg in the barometric scale and the cabin altitude pointer to maximum design differential PSI.

**9369.** How will a failed T/R unit be indicated?

1—Zero amps and negative volts.
2—Zero volts and normal current.
3—Zero volts and double normal amps.
4—Zero amps and normal bus volts.

**9370.** What is the function of the bus tie breaker?

1—Connect the generator to a common bus.
2—Control the RPM of the constant speed drive unit.
3—Disengage the generator from its drive mechanism in case of electrical emergency.
4—Disconnect the generator from its bus when ground power is being utilized.

**9371.** What is the purpose of a generator field switch?

1—De-activate the generator when tripped.
2—Connect the generator bus to the sync bus.
3—Connect the generator to its bus, if the generator is up to speed.
4—Supply the generator field with residual voltage.

**9372.** Which are functions of the generator constant speed drive?

1—Produce constant generator speed and voltage; provide for disconnect of the generator from the engine.
2—Maintain constant frequency and balance loads of parallel generators.
3—Balance loads of isolated generators and compensate for variations in engine RPM.
4—Maintain constant frequency and voltage.

**9373.** Which unit converts 115 volts a.c. to 28 volts a.c. for aircraft lighting?

1—Transformer/rectifier.
2—Step-down transformer.
3—Reverse current relay.
4—Static invertor.

**9374.** What condition is indicated if the generator synchronizing lights are flashing alternately?

1—Either low or high frequency; the generator should not be used.
2—Low frequency; operate the generator isolated.
3—Normal conditions.
4—Phase reversal; the generator should not be used.

**9375.** Which condition is indicated when both a.c. generator synchronizing lights are on?

1—The selected generator frequency is the same as the synchronous bus.
2—The selected generator is out of phase with the synchronous bus.
3—The selected generator frequency is not the same as the synchronous bus.
4—The selected generator is in phase with the synchronous bus.

**9376.** If it is necessary to manually parallel the generators, how should the second generator be added to the common bus?

1—Close the generator breaker when sync lights are flashing alternately.
2—Close the bus tie when both sync lights are out.
3—Close the bus tie when both sync lights are on.
4—Close the generator breaker when both sync lights are out.

**9377.** Which is an indication a T/R is inoperative?

1—Amps negative and volts zero.
2—Amps zero and volts zero.
3—Volts normal and amps zero.
4—Amber warning light comes on.

**9378.** Which most commonly signifies the Mach/airspeed limit has been exceeded?

1—Steady bell ring.
2—Intermittent horn.
3—Wailing horn (siren).
4—Clacker will sound.

**9379.** What is the relationship between static air temperature and ram air temperature while in cruising flight at high altitude?

1—Static air temperature is always lower (colder) than ram air temperature.
2—Static air temperature minus ram air temperature equals true air temperature.
3—Ram air temperature plus true air temperature equals static air temperature.
4—Ram air temperature is always lower (colder) than static air temperature.

**9380.** Which temperature indication is provided by the total air temperature gauge?

1—Ambient air temperature.
2—OAT corrected for static system error.
3—OAT plus ram rise.
4—Ram air temperature corrected for ram rise.

**9381.** Which is a feature of the Mach/airspeed warning system?

1—The warning can be cut off by activating the yaw damper.
2—Limiting airspeed ($V_{MO}$) increases with altitude.
3—The warning can be silenced by a cutout switch.
4—Limiting Mach ($M_{MO}$) increases with altitude.

**9382.** Which sources operate a Machmeter?

1—Pressure altitude and ambient temperature corrections applied to indicated airspeed data.
2—Air data computers.
3—Pitot and static.
4—Computed data from the SAT/TAS indicator.

**9383.** In addition to the flight instruments, with which systems are the static ports associated?

1—Air data computer, flight recorder, and cabin pressure warning switch.
2—Cabin pressure control, flight recorder, and cabin altimeter.
3—Cabin pressure control, air data recorder, and cabin altimeter.
4—Air data computer, cabin pressure control, and flight recorder.

**9384.** Which is a feature of the pneumatic emergency brake system?

1—Pneumatic braking locks all the main gear wheels.
2—With the pneumatic system, the pressure to the brakes cannot be regulated.
3—Differential braking is available.
4—The antiskid system is not effective during pneumatic brake operations.

**9385.** During flight, with the gear handle and the landing gear in the down position, the antiskid system

1—prevents full brake application, but permits sufficient pressure to prevent wheel rotation.
2—permits full brake application by use of the brake pedals.
3—prevents any brake application.
4—permits automatic brake application.

**9386.** Which radar mode should be selected to monitor heavy storm areas?

1—TEST.
2—STANDBY
3—CONTOUR.
4—MAP.

**9387.** During refueling, or on a congested ramp, which radar mode positions are safe to use?

1—TEST or STANDBY.
2—CONTOUR or MAP with the antenna tilt 15 degrees up.
3—STANDBY, NORMAL, or TEST with the antenna tilt 15 degrees down.
4—STANDBY or CONTOUR.

**9388.** Which adjustment can be made on a radio altimeter?

1—Airport elevation.
2—Altimeter setting.
3—Barometric pressure.
4—Decision height.

**9389.** What drives the $N_1$ and $N_2$ engine compressors?

1—$N_1$ driven by first and second stage turbines, $N_2$ driven by the aft stage turbines.
2—$N_1$ and $N_2$ driven together by all turbines through an interconnect drive gear.
3—$N_2$ driven by the aft stage turbines, $N_2$ driven by first and second stage turbines.
4—$N_1$ driven by the aft stage turbines, $N_2$ driven by the first stage turbine.

**9390.** What is the function of an air-start envelope?

1—Determine if $N_1$ and $N_2$ are within limits for the indicated airspeed and pressure altitude.
2—Determine if sufficient air is available in the air-start bottle for the altitude and airspeed.
3—Select the desired idle RPM for an indication of the correct time to activate in-flight ignition.
4—Determine the RPM to which the starter must accelerate the engine prior to moving the start lever out of cutoff.

**9391.** During a normal engine start, which is a visual indication of starter cutout?

1—Oil pressure light goes out.
2—Fluctuation of the starter control system amperage.
3—Increase in duct pressure.
4—Reduction of starter speed.

**9392.** Which is the source of power for mechanical actuation of the thrust reverser system?

1—Engine lubrication system pressure.
2—High-pressure bleed air.
3—Low-pressure bleed air.
4—Hydraulic pressure.

**9393.** Excessive use of fuel heat may cause

1—high or fluctuating oil pressure.
2—fuel temperature to exceed limits.
3—fuel flow fluctuations.
4—higher than normal oil temperature.

**9394.** If prior to starter cutout, the fuel flow exceeds the starting limit, what action should be taken?

1—Place the start lever in cutoff and release the start switch.
2—Place the start lever in cutoff and continue to motor the engine until fuel flow and EGT decrease.
3—If the EGT is within limits, continue the start regardless of the other indications.
4—Decrease fuel flow by momentarily placing the start lever in cutoff, then back to start as necessary.

**9395.** How many minutes of dump time would be required to reach maximum landing weight at the touchdown, under the following conditions?

Cruise weight..... 171,000 lb
Max. landing weight..... 142,000 lb
Average fuel flow during dumping and descent to touchdown..... 3,170 lb/hr/eng
Time from start dump to landing..... 19 min
Fuel dump rate..... 2,300 lb/min

1—12.4 minutes.
2—10.1 minutes.
3—11.1 minutes.
4—9.5 minutes.

**9396.** What condition is necessary for arming an engine fire extinguisher?

1—The fire switch must be pulled out.
2—A fire signal must be present.
3—The bottle discharge button must be depressed.
4—The battery switch must be on.

**9397.** An airplane has been cruising for 2 hours 45 minutes at a speed of Mach .80. Total fuel consumed during this period has been 34,000 pounds. If Mach 1.0 is 589 knots, what has been the nautical air miles/1,000 pounds of fuel?

1—38.1 nautical air miles/1,000 pounds.
2—40.0 nautical air miles/1,000 pounds.
3—43.7 nautical air miles/1,000 pounds.
4—46.4 nautical air miles/1,000 pounds.

**9398.** An airplane has been cruising for 2 hours 40 minutes at a speed of Mach .84. Total fuel consumed during this period has been 34,000 pounds. If Mach 1.0 is 590 knots, what has been the nautical air miles/1,000 pounds of fuel?

1—38.1 nautical air miles/1,000 pounds.
2—38.9 nautical air miles/1,000 pounds.
3—40.0 nautical air miles/1,000 pounds.
4—42.5 nautical air miles/1,000 pounds.

**9399.** Which of these factors has the effect of reducing critical engine failure speed?

1—Slush on the runway and inoperative antiskid.
2—Dry runway with no slope.
3—Dry runway with uphill slope.
4—Higher gross weight.

**9400.** Under the following conditions, determine the new CG position relative to MAC as a result of removing 5,000 pounds of cargo from station 1170.0.

Aircraft weight..... 250,000 lb
CG position..... 25.5% MAC
Length of MAC..... Sta. 763.0 to 1035.3

1—27.5 percent.
2—28.4 percent.
3—29.3 percent.
4—31.7 percent.

**9401.** If 5,000 pounds of cargo is removed from station 1170, what is the new CG position relative to MAC when utilizing the following data?

Aircraft weight.....300,000 lb
CG position.....24.5% MAC
Length of MAC.....Sta. 763.0 to 1035.3

1—21.7 percent.
2—22.4 percent.
3—24.3 percent.
4—26.6 percent.

**9402.** What is the maximum payload under the following conditions?

Basic operating weight.....150,000 lb
Max. zero fuel weight.....230,000 lb
Max. landing weight.....265,000 lb
Max. takeoff weight.....340,000 lb
Fuel tank load.....102,000 lb
Est. fuel burn en route.....75,500 lb

1—88,500 pounds.
2—84,000 pounds.
3—80,000 pounds.
4—75,500 pounds.

**9403.** Before takeoff, 6,500 pounds of cargo is shifted from the aft to the forward compartment. What is the new CG location?

Takeoff weight.....270,000 lb
CG.....32.7% MAC
MAC.....763.0" to 1035.3"
Compartment locations:
  Fwd.....500"
  Aft.....1,010"

1—28.2 percent.
2—29.6 percent.
3—30.4 percent.
4—31.5 percent.

**9404.** What oxygen flow condition should exist if the regulator selector is placed in the emergency position and the supply lever is on?

1—Continuous flow of diluted oxygen under positive pressure.
2—Continuous flow of 100 percent oxygen under positive pressure.
3—100 percent oxygen available on demand.
4—Diluted oxygen available on demand.

**9405.** What is the function of a turbocompressor?

1—Compress outside air and permit expansion through a turbine to create a temperature drop.
2—Use engine turbine air to compress cabin air for high-altitude operations.
3—Use engine or ground cart air to compress outside air for air conditioning and pressurization.
4—Use engine bleed air to compress outside air for pressurization and heating.

**9406.** After the shutdown of one engine, how many minutes of dump time would be required to reach maximum landing weight by touchdown?

Cruise weight.....245,000 lb
Max. landing weight.....185,000 lb
Average fuel flow during dumping and descent to touchdown.....3,100 lb/hr/eng
Time from start dump to landing.....24 min
Fuel dump rate.....3,620 lb/min

1—13.2 minutes.
2—14.9 minutes.
3—15.5 minutes.
4—16.6 minutes.

**9407.** After shutting down one engine, how many minutes of dump time would be required to reach the maximum landing weight at touchdown?

Cruise weight.....270,000 lb
Max. landing weight.....207,000 lb
Average fuel flow during dumping and descent to touchdown.....3,750 lb/hr/eng
Time from start dump to landing.....21 min
Fuel dump rate.....3,660 lb/min

1—14.9 minutes.
2—16.1 minutes.
3—17.2 minutes.
4—21.0 minutes.

**9408.** How is the engine fuel shutoff valve closed during the engine fire procedure?

1—By closing the throttle lever.
2—Moving the start lever to cutoff.
3—Pressing the extinguisher discharge switch.
4—Pulling the fire switch.

**9409.** Which is the normal in-flight source of hot air for the freon air conditioning system?

1—Turbocompressor discharge air.
2—Engine turbine section air.
3—Engine fan air.
4—Electric heat exchanger.

**9410.** During ground operations, which would cause an intermittent horn to sound when throttles are advanced?

1—Gust lock system still in the latched position.
2—Landing gear control lever out of the down detente position.
3—Either right or left emergency bus power failure.
4—Ground spoilers not fully retracted.

**9411.** The EPR system is present in the aircraft cockpit to indicate

1—compression ratio.
2—thrust.
3—inlet pressure.
4—exhaust temperature.

**9412.** What is the affect of altitude changes on the duration of the crew oxygen system?

1—Duration remains constant with altitude when using either 100 percent or normal oxygen.
2—Increasing altitude decreases duration when using 100 percent oxygen.
3—Duration remains constant with altitude change when using 100 percent oxygen, but decreases with altitude when using normal oxygen.
4—Increasing altitude increases duration when using either 100 percent or normal mode.

**9413.** How are flight control surfaces normally operated?

1—Aerodynamic tabs which exert force on the control surfaces.
2—Manual force through the control column directly linked to the control surface.
3—Electric actuators.
4—Hydraulic actuators.

**9414.** Which is a feature of the airspeed limit system?

1—Limiting airspeed CAS increases slightly from sea level up to 17,000 feet.
2—The warning is cut out if the captain's pitot/static switches are turned off.
3—Limiting Mach number decreases above 17,000 feet.
4—The warning can be cut out by depressing the alarm bell cutout switch.

**9415.** Exceeding the $V_{MO}$ airspeed limit is indicated by

1—an aural alarm system.
2—the stick shaker system.
3—a visual warning signal.
4—a decrease in propeller RPM.

**9416.** What happens in the fuel system when an engine fire emergency handle is pulled?

1—The cable-operated fire emergency valve is closed.
2—The fire emergency and cross-feed valves for the engine are closed.
3—Boost pumps are deactivated and the tank valve is closed.
4—The firewall shutoff valve is closed.

**9417.** Which indicators should be monitored while using an airfoil anti-icing system?

1—Leading edge temperature indicators and overtemperature warning lights.
2—Deicing ammeters, wing and empennage temperature indicators, and over-temperature warning lights.
3—Over-temperature warning lights and cycling lights.
4—Airfoil temperature indicators and anti-icing ammeter.

**9418.** In the engine anti-icing system, which is a source of heat?

1—Compressor section hot air for the engine inlet scoop.
2—Compressor section hot air for the engine inlet guide vanes.
3—Bleed air system hot air for the engine inlet guide vanes.
4—Bleed air system hot air for the engine shaft housing.

**9419.** What type of system is used for control of ice on the wing leading edges?

1—Inflated boot deicing system.
2—Anti-icing using heated air from the bleed air system.
3—Bleed air deicing system.
4—Electric anti-icing using the alternating current system.

**9420.** What is measured by the torquemeter system?

1—Twist of the helical spline ring gear.
2—Axial movement of the prop shaft.
3—Twist of the extension shaft.
4—Difference between compressor inlet pressure and turbine outlet pressure.

**9421.** Which may cause turboprop engine compressor stall?

1—Excessive angle of attack on the compressor blades.
2—Excessive EPR for the particular RPM.
3—Back flow of air from the combustion chambers.
4—Insufficient fuel flow during acceleration.

**9422.** Which formula indicates the power output (neglecting propeller losses) of a turboprop engine?

1—Equivalent shaft horsepower + jet horsepower = shaft horsepower.
2—Equivalent shaft horsepower + jet thrust (lb) = shaft horsepower.
3—Shaft horsepower + jet thrust (lb) = total horsepower.
4—Shaft horsepower + jet horsepower = total equivalent shaft horsepower.

**9423.** With a reduction gear ratio of 13.54:1 and a propeller RPM of 1,032, what is the compressor RPM?

1—6,987 RPM.
2—13,973 RPM.
3—15,250 RPM.
4—66,368 RPM.

**9424.** A compressor is turning 13,820 RPM coupled with a reduction gear ratio of 13.54:1. What is the propeller RPM?

1—502 RPM.
2—980 RPM.
3—1,020 RPM.
4—1,863 RPM.

**9425.** When does the fuel control governor begin limiting RPM?

1—At and above 103.5 percent RPM.
2—During low-speed operations.
3—When the propeller governor is locked out.
4—When the NTS system operates.

**9426.** The tachometer generator for one engine becomes inoperative. The MEL may allow flight if RPM can be determined by other means. Which would be an accurate indication of engine RPM?

1—Fuel flow.
2—Turbine inlet temperature.
3—Propeller beat during synchrophase operation.
4—Generator frequency.

**9427.** In the event of complete a.c. electrical failure during cruise flight, which instrument will still function?

1—Fuel flow.
2—TIT.
3—RPM.
4—Engine fuel pressure.

**9428.** What action should be taken if flames spread beyond the tailpipe during an engine start?

1—Place the engine condition lever to feather.
2—Pull the starter switch.
3—Place the engine condition lever to ground stop.
4—Follow the engine shutdown procedure.

**9429.** During a ground start attempt, what action should be taken if there is excessive tailpipe torching?

1—Place the condition lever in ground stop and continue motoring with the starter.
2—Advance the throttle, turn off the fuel boost pumps and continue the start.
3—Pull the fire control handle and continue motoring with the starter.
4—Discontinue the start and use the engine fire-extinguishing system.

**9430.** During normal operations, how is the engine shut down?

1—Stopping fuel flow at the tank valve.
2—Interrupting current to the ignition system.
3—Stopping fuel flow at the fuel control.
4—Stopping fuel flow at the firewall shutoff.

**9431.** When takeoff is made under high ambient temperature conditions, which engine limit is most likely to be exceeded first?

1—RPM.
2—Oil temperature.
3—TIT.
4—Torque.

**9432.** Which would be a reason for an immediate engine shutdown in flight?

1—An indication of zero turbine inlet temperature.
2—Sudden drop in engine oil pressure.
3—An indication of zero RPM.
4—Sudden turbine temperature rise during a power increase.

**9433.** What blade angle will be attained by the propeller when reverse thrust is used?

1—A blade angle determined by the propeller governor spring tension.
2—Blade angle is determined by the power lever position.
3—Against the flight idle low-pitch stop.
4—Against the full reverse pitch stop.

**9434.** What is the comparison between propeller blade angles in low speed and high speed ranges at a given power lever (throttle) position?

1—Identical for low and high speed; regardless of all other variables.
2—Ground idle low pitch for low speed range; flight idle low pitch top for high speed range.
3—Relatively high for the high speed range, and low for the low speed range.
4—Relatively high for the low speed range, and low for the high speed range.

**9435.** During flight, the torque, TIT, and fuel flow are near zero; power section oil pressure is low; hydraulic pressure, a.c. generator, RPM and gearbox oil pressures are normal. Which condition is indicated by these symptoms?

1—Gearbox failure.
2—In-flight decoupling of the gearbox.
3—Single phase power failure.
4—Stepdown transformer failure.

**9436.** What are the instrument indications of a decoupled propeller reduction gearbox?

1—High RPM, low fuel flow, low TIT, low torque (horsepower).
2—Normal RPM, high fuel flow, high TIT, low torque (horsepower).
3—Low RPM, low fuel flow, low TIT, negative torque (horsepower).
4—Normal RPM, low fuel flow, low TIT, low torque (horsepower).

**9437.** What is the function of the propeller synchrophase system?

1—Maintain slave engine RPM within 3 percent of the master engine RPM.
2—Set the blades of all propellers to an identical blade angle.
3—Maintain each slave engine propeller blade angle to within 3 degrees of the master blade angle.
4—Maintain a predetermined angular relationship between the blades of all propellers as they rotate.

**9438.** In the event of brake overheat on landing, which precaution should be taken?

1—Use a hand fire extinguisher, preferably $CO_2$, for cooling.
2—Approach the wheel well from the fore or aft only.
3—Evacuate the aircraft via the overhead escape hatches only.
4—Discharge the GTC fire extinguisher.

**9439.** If the flight engineer should select the auxiliary (ambient) ventilation mode while cruising at altitude, what would most likely occur?

1—Rapid decompression.
2—Excessive cooling flow.
3—Overspeed of the cabin supercharger (compressor).
4—Reduction in cabin altitude.

**9440.** During a descent, when will the negative pressure relief valve open?

1—When the cabin pressure controller is reset.
2—When the aircraft altitude becomes less than the cabin altitude.
3—When aircraft altitude becomes greater than cabin altitude.
4—Upon equalization of cabin and aircraft altitude.

**9441.** What is the function of the cabin negative pressure relief valve?

1—Prevent atmospheric pressure from exceeding cabin pressure.
2—Prevent exceeding 2.04" Hg differential pressure while on the ground.
3—Prevent a pressure differential between the main cabin and the lower cargo compartments.
4—Prohibit landing with a positive cabin pressure.

**9442.** If the cabin pressure safety relief valve is set to open at 6.5 PSI pressure differential, at approximately what cabin pressure will it open if the outside atmospheric pressure is 14.45 inches of mercury?

1—21.0 PSI.
2—21.0" Hg.
3—27.5 PSI.
4—27.5" Hg.

**9443.** Which is the correct sequence of components encountered by the cabin air as it flows through an air cycle cooling system?

1—Compressor, evaporator, heat exchanger, and turbine.
2—Evaporator, turbine, and heat exchanger.
3—Turbine, compressor, and heat exchanger.
4—Heat exchanger and turbine.

**9444.** If a warning horn sounds intermittently in cruise flight, what should you most likely check?

1—Outflow valve position.
2—Cabin altitude.
3—Differential pressure.
4—Stabilizer position.

**9445.** What pressurization system operation should be changed in the event that the cabin rate of climb is too fast?

1—Close the outflow valve faster.
2—Increase cabin compressor speed.
3—Close the outflow valve slower.
4—Decrease cabin compressor speed.

**9446.** If cabin altitude becomes greater than pressure altitude, what correction should be made?

1—Close the outflow valve.
2—Open the positive pressure emergency relief valve.
3—Open the negative pressure relief valve.
4—Disconnect the supercharger (compressor) drive.

**9447.** Which electrical protective device can be manually reset and held on after having been actuated by an excessive current flow?

1—Time delay fuses.
2—Single pole; double throw switches.
3—Limiter switches.
4—Nontrip free circuit breakers.

**9448.** Which type fault causes the bus to transfer, but automatically reinstates the faulty generator to its bus again, if the fault is only a temporary condition?

1—Under voltage fault.
2—Over or under frequency fault.
3—Feeder fault or shorted bus.
4—Over or under amperage fault.

**9449.** What indication would the instantaneous vertical speed indicator provide during entry to a 500 feet per minute actual descent from level flight with normal static ports iced over?

1—Initially a climb, then a descent at a rate in excess of 500 feet per minute.
2—The instantaneous vertical speed indicator would indicate normally because its source of pressure is the alternate static ports.
3—The instantaneous vertical speed indicator pointer would indicate a descent, but at a rate less than 500 feet per minute.
4—Rate of descent indication would remain at zero regardless of the actual rate of descent.

**9450.** During the walk-around inspection, you observe covers over the pitot probes. Which would be affected if the covers were not removed?

1—Cabin differential, flight recorder, altimeter, instantaneous vertical speed indicator, and airspeed.
2—Flight recorder, autopilot, instantaneous vertical speed indicator, and airspeed.
3—Airspeed, altimeter, and autopilot.
4—Flight recorder, airspeed, and autopilot.

**9451.** If the fuel temperature is higher than standard, how will the sight (drip) gauge readings compare with fuel quantity gauge readings?

1—Both will read the same and correct.
2—The quantity gauge will read lower.
3—Both will read the same and incorrect.
4—The quantity gauge will read higher.

**9452.** When bleed air is used for anti-icing, what change occurs to engine operation?

1—Engine oil temperature increases.
2—Fuel flow increases.
3—Fuel flow decreases.
4—TIT increases.

**9453.** Which is directly controlled by movement of the power lever (throttle) during taxi operations?

1—Propeller blade angle.
2—Fuel pump pressure.
3—Turbine temperature limit.
4—Compressor RPM.

**9454.** Which operating range is associated with the power lever range from flight idle to maximum reverse?

1—Flight idle range.
2—Taxi or beta range.
3—Pitch change range.
4—Temperature controlling range.

**9455.** What is the effect of changes in ambient air density and temperature on turboprop engines?

1—Airflow volume through the engine increases as air density decreases.
2—Airflow volume through the engine decreases as air density increases.
3—Thrust increases as the temperature increases.
4—Thrust decreases as the temperature increases.

**9456.** Which condition can be caused by the use of bleed air for engine airscoop anti-icing?

1—Reduction of turbine inlet temperature.
2—Reduction of cabin temperature.
3—Reduction of cabin compressor inlet pressure.
4—Reduction of shaft horsepower.

**9457.** What type unit is ordinarily provided to prevent accumulations of fuel ice in the fuel control unit?

1—An air heater which uses bleed air from the final turbine stage.
2—A fuel to hydraulic fluid heat exchanger which uses heat from the hydraulic fluid which has been extracted from hydraulic pump cooling.
3—A fuel to oil heat exchanger which uses the heat from engine scavenge oil.
4—An electric immersion heater in the fuel manifold.

**9458.** The medium used to heat fuel in a heat exchanger is

1—engine pressure oil.
2—engine diffuser bleed air.
3—engine scavenge oil.
4—a.c. hydraulic return fluid.

**9459.** In flight, which is used to vary engine power?

1—Propeller blade angle.
2—Fuel flow and turbine temperature.
3—Turbine RPM.
4—Fuel/air ratio.

**9460.** During normal cruise flight, which is the principle control of engine compressor RPM?

1—Ambient air temperature.
2—Propeller governor.
3—Power lever position.
4—Fuel control governor.

**9461.** What does the engine horsepower gauge indicate?

1—Power delivered to the reduction gearbox.
2—Power delivered to the propeller.
3—Thrust produced by the propeller.
4—Thrust produced by the propeller and the jet exhaust.

**9462.** Which is a feature of the autofeather system?

1—Autofeather should be armed during cruise flight in turbulent air.
2—Pulling the throttle back on takeoff will cause autofeather to engage.
3—Autofeather will operate on approach if the landing gear is down.
4—Autofeather of one engine disarms autofeather on the remaining operating engines.

**9463.** What condition normally exists in the propeller governor during an overspeed condition?

1—Governor pump oil pressure is too high.
2—Governor pump oil pressure is too low.
3—Flyweight force is greater than speeder spring force.
4—Flyweight force is less than speeder spring force.

**9464.** What modes of operation are normal for the turbopropeller?

1—Controllable pitch below flight idle; constant speed above flight idle.
2—Fixed pitch on the ground; phase sync in the air.
3—Controllable pitch on the ground; constant speed in the air.
4—Fixed pitch below flight idle; phase sync above flight idle.

**9465.** What is the purpose of the synchrophasing system?

1—Decrease vibration and set all propellers to the same blade angle.
2—Obtain the same power and fuel flow from all engines.
3—Decrease vibration and reduce noise levels.
4—Prevent overspeed during power lever (throttle) application.

**9466.** Of the choices available, which is the preferred method of combating a brake fire on the ground?

1—Spray warm water fog over the wheel and brake assembly.
2—Completely smother the gear with a foam extinguishing agent.
3—Keep the engine running to blow out the fire.
4—Apply a dry chemical fire extinguisher.

**9467.** Compute the cabin rate of climb required to arrive at cruise altitude and desired cabin altitude simultaneously when operating under conditions No. 3.

1—500 feet per minute.
2—528 feet per minute.
3—605 feet per minute.
4—650 feet per minute.

**9468.** On descent, cabin pressure is compensated by gradual

1—reduction of cabin supercharger air volume output.
2—closing of the cabin supercharger delivery duct damper.
3—opening of the vacuum relief valve.
4—opening of the outflow valve.

**9469.** What means is used to control the output of a cabin supercharger during a descent?

1—Pressure of the hot air which drives the supercharger turbine is gradually reduced.
2—Discharge duct valve is gradually opened to increase the rate of airflow being vented overboard.
3—The scoop which admits ambient air to the impeller is gradually closed by an inlet valve.
4—The supercharger variable speed drive gradually decreases the speed of the supercharger impeller.

**9470.** If the cabin outflow valve is adjusted to close too fast during a climb, cabin rate of climb will be

1—slower than desired.
2—faster than desired.
3—zero to 5,000 feet, then the same as aircraft rate of climb.
4—the same as aircraft rate of climb for the entire climb.

**9471.** On a large reciprocating engine powered airplane, what is the purpose of the generator paralleling system?

1—Obtain equal generator voltages.
2—Obtain equal generator loads.
3—Adjust generator voltage, speed, and phase angle.
4—Connect all buses together when the generators have exactly the same (parallel) voltage output.

**9472.** What is a probable cause of a generator producing zero amperage and residual voltage?

1—Faulty ammeter.
2—Reverse current relay main contactor points are stuck open.
3—Main feeder line is disconnected at the bus bar.
4—Generator field circuit breaker is open.

**9473.** If a large reciprocating radial engine experiences rapid fluctuation of fuel pressure, fuel flow, and engine power during cruise flight, what problem is indicated?

1—Vapor lock.
2—Carburetor ice.
3—Hydraulic lock.
4—Fuel ice.

**9474.** What is the definition of BMEP?

1—Indicated horsepower less friction horsepower.
2—The portion of combustion chamber pressure that produces useful power at the propeller shaft.
3—Total average pressure produced in the combustion chamber.
4—Torque delivered to the propeller reduction gearing at maximum rated RPM.

**9475.** Which factor has the effect of decreasing takeoff BMEP when rated takeoff MAP and RPM are applied?

1—Use of low blower.
2—Use of water injection.
3—Dry air.
4—High humidity.

**9476.** How will engine performance be affected if constant RPM and constant MAP are maintained in a climb from sea level to critical altitude?

1—Throttle position will gradually close.
2—Brake horsepower will gradually decrease.
3—Throttle position will remain fixed.
4—Brake horsepower will gradually decrease.

**9477.** How should the carburetor alcohol system be used?

1—When there is an unexplained decrease in manifold pressure.
2—Before entering known icing conditions.
3—When carburetor heat is unable to remove or prevent ice formation.
4—Only if the application of carburetor heat causes an excessive BMEP drop.

**9478.** If there is a 7 BMEP drop when the ignition switch is moved from both to left and there is no change of BMEP when the switch is moved from both to right, what is the probable cause?

1—Right magneto ignition switch wire is open.
2—Left magneto ignition switch wire is open.
3—Right magneto ignition switch wire is grounded.
4—Left magneto ignition switch wire is grounded.

**9479.** Which function is performed by the lubrication system scavenge pump?

1—Pump oil from the engine, through the cooler, to the tank.
2—Provide an oil supply to the propeller feathering system.
3—Draw oil from the bottom of the tank to prevent engine driven pump cavitation.
4—Pump oil from the sump, through the hopper, to the oil cooler.

**9480.** What is the function of the automatic mixture control in the carburetor?

1—Enrichens the mixture at takeoff power settings.
2—Increases fuel flow with decreases of air density.
3—Decreases fuel flow as altitude is increased.
4—Automatically corrects the fuel/air mixture as throttle position is changed.

**9481.** Together with BMEP, which variable is used to calculate limiting brake horsepower?

1—Propeller efficiency ratio.
2—Carburetor air temperature.
3—Manifold pressure.
4—Crankshaft RPM.

**9482.** Why should the high supercharger ratio not be used for takeoff from airports with relatively low field elevations?

1—Excessive BMEP will be developed at takeoff RPM and MAP.
2—Detonation will occur at all power settings above maximum cruise power.
3—Excessive MAP will be needed to obtain takeoff BMEP.
4—Engine overspeeding will result if takeoff MAP is obtained.

**9483.** When carburetor heat is applied while operating in high blower, which precaution should be followed?

1—MAP should be decreased to maintain constant power.
2—CAT should be controlled to prevent detonation.
3—Nacelle flaps should be put in trail to maintain low cylinder head temperature.
4—Carburetor alcohol de-icing should be turned on to prevent overheating the carburetor.

**9484.** During a descent from altitude when should the engine superchargers be shifted from high to low?

1—At high blower critical altitude.
2—At the highest altitude descent power can be obtained in low blower.
3—At the lowest altitude descent power can be obtained in high blower.
4—Immediately prior to starting the descent.

**9485.** To avoid excessive master rod bearing loads during a descent, which procedure should be used?

1—Delay shifting to low blower until the aircraft arrives at initial approach altitude.
2—Adjust throttles to maintain a manifold pressure (inches/Hg) of not more than RPM/100.
3—Delay shifting to auto-rich mixture until the aircraft arrives at final approach altitude.
4—Adjust throttles to maintain at least 1" Hg MAP for each 100 RPM.

**9486.** When shifting from low blower to high blower at a constant throttle setting, what are normal indications?

1—A decrease in BMEP and an increase in MAP.
2—An increase in BMEP and an increase in MAP.
3—An increase in BMEP and a decrease in MAP.
4—A decrease in BMEP and a decrease in MAP.

**9487.** When the dewpoint is high at takeoff, what is an appropriate procedure?

1—Use a slightly lean mixture to obtain maximum takeoff BMEP.
2—Adjust MAP upward to obtain rated takeoff power.
3—Use partial carburetor heat to prevent induction air screen ice.
4—Reduce takeoff BMEP setting to prevent overstressing combustion chambers.

**9488.** During a wet takeoff, if exhaustion of the water supply is evident, what action should be taken by the flight crew?

1—Move the mixture control to AUTO-RICH and turn off the ADI switch.
2—Feather the propeller of the dry engine.
3—Reduce BMEP and turn off the ADI switch.
4—Move the mixture control to auto-rich, then reduce MAP and RPM to upper limits.

**9489.** During the power check (run-up), the engine instruments indicate normal MAP and fuel flow, but low RPM and BMEP. What is the probable trouble?

1—Leaking primer.
2—Several dead cylinders.
3—Propeller is set at a blade angle other than full-low pitch.
4—Over-rich carburetion.

**9490.** During normal taxi operations, which indicate that an engine has stopped firing?

A. Oil pressure warning light on.
B. Manifold pressure increase.
C. Fuel pressure reduced to zero.
D. BMEP increase.
E. Rapid decrease in cylinder head temperature.
F. Generator dropping off bus.

1—A, B, C, D, E, and F.
2—B, D, and E.
3—A, B, and F.
4—A, C, E, and F.

**9491.** During the power check, the engine instruments indicate normal MAP, low RPM and BMEP, and high fuel flow. What is the probable trouble?

1—Rich carburetor.
2—Several dead cylinders.
3—Defective manifold pressure gauge.
4—Propeller is set at a blade angle other than full-low pitch.

**9492.** While conducting the power check, engine instruments indicate normal MAP, RPM, and fuel flow; but low BMEP. What is the possible trouble?

1—Defective torquemeter system.
2—Several dead cylinders.
3—Lean carburetor.
4—Leaking primer.

**9493.** During the start sequence of a twin-row radial engine, there is an indication of a hydraulic lock. How should this lock be cleared?

1—Use the high boost pump and blow out the lock.
2—Turn the propeller backward by hand.
3—Disconnect the hydraulic pump inlet line and prime the pump.
4—Remove the spark plugs from the lower cylinders.

**9494.** If the engine does not start after a reasonable amount of cranking, and there is no fuel draining from the drip valves, what action should be taken?

1—Put the booster pump switch in high and use the primer.
2—Stop cranking because the starter motor has inadequate cooling for continuous operation.
3—Pump the throttle and move the mixture control to auto-rich.
4—Stop cranking and clear the hydraulic lock.

**9495.** When combating an in-flight engine fire, which is the proper procedure?

1—Fuel selector valve should be closed prior to the discharge of a fire extinguishing agent.
2—Cowl flaps and oil cooler flap should be closed prior to discharging the fire extinguishers.
3—Fire extinguishers should be discharged after the propeller is feathered.
4—Fire extinguishers should be discharged for Zone 1 and Zone II fires, but not for Zone III fires.

**9496.** What would be an early indication of oil congealed in the cooler cores?

1—High oil temperature and low oil pressure.
2—High oil temperature and high oil pressure.
3—Low oil temperature and low oil pressure.
4—Low oil temperature and high oil pressure.

**9497.** The master and two engines are operating at 2,200 RPM and the other engine is 100 RPM slower. How can synchronization of all engines, by means of the resynchronization button be accomplished?

1—Pressing the button once if the master lever is in manual position.
2—Holding down the button until all engines are the same RPM.
3—Pressing and releasing the button at least twice.
4—By holding down the button and adjusting the master lever.

**9498.** During cruise flight with all engines at 2,300 RPM, with synchronization on, you use the propeller toggle switch to change the master engine from 2,300 RPM to 2,100 RPM. This will cause the slave engines to

1—reduce to 2,100 RPM.
2—reduce to 2,230 RPM.
3—reduce to exactly 2,237 RPM.
4—remain at 2,300 RPM.

**9499.** What is the effect of moving the master RPM control lever full forward?

1—All propellers will change to the full low pitch stop setting.
2—All propellers are changed to the same low pitch blade angle as the master engine propeller.
3—Each governor will change to their individual full high RPM setting.
4—All engine RPM's are calibrated at 2,800 RPM.

**9500.** Concerning the Hamilton Standard propeller synchronization system, which is correct?

1—During synchronizer operation, either No. 1 or No. 4 engine must be selected as the master.
2—When the synchronizer system is off or inoperative, the propellers can be synchronized with the toggle switches.
3—When the master control lever is moved to a new position, all propellers synchronize automatically.
4—When the master control lever is moved full forward, each propeller moves to full high pitch.

**9501.** When the autofeather green lights are on, it is an indication that

1—the autofeather test switch is on.
2—a propeller has feathered automatically.
3—the autofeather system must be reset.
4—the autofeather system is armed.

**9502.** If engine No. 4 fails on takeoff and its propeller autofeathers, then 5 seconds later engine No. 2 fails, what happens to No. 2 propeller?

1—Cannot autofeather because its autofeather swjtch is disarmed.
2—Cannot be feathered manually until the autofeather switches are reset.
3—Will autofeather when the No. 4 feathering button returns to normal.
4—Will autofeather when the No. 4 autofeather light goes out.

**9503.** What condition normally exists in the propeller governor during an overspeed condition?

1—Governor pump oil pressure is too high.
2—Flyweight force is less than speeder spring force.
3—Flyweight force is greater than speeder spring force.
4—Governor pump oil pressure is too low.

**9504.** In the Hamilton Standard reversible propeller, which blade angle position is not limited by a positive mechanical stop?

1—Full reverse pitch.
2—Full feathering pitch.
3—Full high pitch in governing range.
4—Full low pitch in governing range.

**9505.** How do the propeller blades react when the piston in the dome is moved forward?

1—Unreverse position.
2—Increased blade angle.
3—Decreased blade pitch.
4—Feather position.

**9506.** What action should be taken if a propeller accidentally goes into reverse pitch during cruise flight?

1—Place the throttle in forward high power, trip the prop reverse circuit breakers, and then feather the propeller.
2—Place the throttle in forward idle and feather the propeller.
3—Place the throttle in reverse idle and the mixture control in idle cutoff.
4—Place the throttle in reverse idle and feather the propeller.

**9507.** How should the propellers be adjusted for climbing flight after takeoff?

1—Pull the master RPM control lever back until master engine is at desired RPM, then trim other engines as required with toggle switches.
2—Reduce RPM with the master lever and press the resync button, if needed.
3—Use the toggle switch for each prop to obtain climb RPM.
4—Reduce manifold pressure with the throttles, then press the resync button, if needed.

**9508.** What action should be taken if an engine overspeed cannot be controlled by a reduction of power?

1—Pull the fire control and discharge one bottle of extinguishant to the engine.
2—Move the mixture to idle cutoff.
3—Feather the propeller.
4—Switch to the alternate master engine.

**9509.** Deadhead transportation is defined as

1—transportation to or from a duty assignment.
2—the time spent on the ground between scheduled flights, during an extended trip.
3—the time spent by a crewmember on a flight who is not performing a required function, except in the event of need to relieve one of the required crew.
4—travel by airline employees, or others in a nonfare capacity.

**9510.** If your turbojet transport airplane is equipped with outboard ailerons, in what flight regime will they be used?

1—Low speed operations.
2—High speed operations.
3—Transonic flight.
4—Flight operations below FL180.

**9511.** In which condition is "St. Elmo's fire" usually encountered?

1—Very dry air.
2—Upon penetrating a warm front.
3—Along coastal areas with heavy humidity.
4—While in precipitation in the vicinity of thunderstorms.

**9512.** Does placing the magneto switch in the OFF position guarantee that the propeller is safe to handle?

1—Yes, because the system is grounded completely.
2—No, since a loose or broken "P" lead can allow the engine to start.
3—Yes, because the entire electrical system is shut down through the magneto switch.
4—No, since the magneto switch has nothing to do with the propeller.

**9513.** Which is a major advantage associated with reversing propellers?

1—Steeper approaches through additional thrust drag.
2—Improved cooling by the reversed flow of air.
3—Improved ground maneuverability.
4—Reduced tire wear.

**9514.** Before allowing anyone near a propeller, in what positions should the cockpit controls be placed?

1—Throttle - IDLE; Mixture - IDLE CUT-OFF; Magnetos - OFF.
2—Throttle - OPEN; Mixture - IDLE CUT-OFF; Magnetos - OFF.
3—Throttle - IDLE; Mixture - RICH; Magnetos - OFF.
4—Throttle - OPEN; Mixture - RICH; Magnetos - OFF; Propeller - FEATHER.

**9515.** Which cockpit control is used to place the propeller in reverse?

1—Feather button.
2—Propeller control.
3—Mixture control.
4—Throttle.

**9516.** What color is the arc placed on a tachometer to indicate a critical vibration range?

1—Blue.
2—Red.
3—Yellow.
4—Green.

**9517.** Which is a requirement for a feathering system that uses engine oil to feather the propeller?

1—A supply of oil must be reserved for feathering use only.
2—A standpipe must be installed in each oil tank.
3—The feathering system must be capable of being activated with the starter.
4—The system must be capable of utilizing oil from another engine in the case of total engine failure.

**9518.** During the preflight of a propeller blade, which is the most critical location of stress concentration to be checked?

1—Where the blade enters the hub.
2—Halfway between the tip and the hub.
3—Six inches outboard of the hub.
4—Six inches inboard of the tip.

**9519.** Hollow steel propellers are most commonly found on which type of aircraft?

1—Small, single-engine aircraft.
2—Single-engine and multiengine aircraft under 12,500 pounds.
3—Aircraft other than transport category aircraft.
4—Transport category aircraft.

**9520.** A constant-speed propeller system is best described as a system in which the propeller blade angle is varied by the action of

1—aerodynamic forces acting against counterweights.
2—a selector valve allowing oil to move a piston in the dome.
3—a governor to maintain a constant system RPM.
4—oil metered into and out of the propeller dome through a cockpit control lever.

**9521.** During the engine preflight check of a two-position propeller, why should the propeller be operated through three full pitch-change cycles?

1—Purge entrapped air from the propeller dome.
2—To be sure warm engine oil is in the propeller for proper operation.
3—Determine the propeller stops are functioning to avoid a runaway prop on takeoff.
4—Free up the cable linkage for smooth propeller operations.

**9522.** Which governor component opposes the movement of the flyweights?

1—Speeder spring.
2—Pilot valve.
3—Driveshaft.
4—Speeder rack.

**9523.** To return to an "onspeed" propeller condition from an "overspeed" propeller condition, how would the propeller and governor be affected?

1—Flyweights will tilt inward and the blade angle will decrease.
2—Flyweights will tilt inward and the blade angle will increase.
3—Flyweights will tilt outward and the blade angle will decrease.
4—Flyweights will tilt outward and the blade angle will increase.

**9524.** In the constant speed propeller system, an increase in throttle would cause

1—a decrease in propeller blade angle and a decrease in RPM.
2—an increase in propeller blade angle only.
3—a decrease in propeller blade angle only.
4—an increase in propeller blade angle and an increase in RPM.

**9525.** In cruising flight, which combination would cause an increase in manifold pressure?

1—Pulling the propeller control aft with throttle unchanged.
2—Pushing the propeller control forward with throttle unchanged.
3—Pushing the propeller control forward and pulling the throttle aft.
4—Pulling the propeller control aft and pulling the throttle aft.

**9526.** Which is correct when feathering a hydromatic propeller?

1—The feather button is pushed in and held until the feathering cycle is complete.
2—The propeller control is pulled full aft and held until the feathering cycle is complete.
3—Once the feather button is pushed, the feathering cycle will complete automatically.
4—Feathering is accomplished by holding the feather button in while pulling the propeller control full aft.

**9527.** What force holds the hydromatic propeller blades in feather?

1—Oil pressure in the top of the propeller dome.
2—Oil pressure at the bottom of the propeller dome.
3—Aerodynamic force.
4—A feather lock armed in place at the end of the feather circuit cycle.

**9528.** If a hydromatic propeller can be feathered and unfeathered, but fails to respond to the propeller control lever, what is most likely the problem?

1—Governor failure.
2—Dome piston failure.
3—Blown propeller seals.
4—Distributor valve failure.

**9529.** When a hydromatic propeller feathers, then immediately unfeathers, the problem may be a

1—defective pressure cutout switch.
2—defective propeller control.
3—failed piston-to-dome seal.
4—hydraulic lock in the dome.

**9530.** What force opposes governor oil pressure in the hydromatic propeller?

1—Dome oil pressure.
2—Flyweights.
3—Speeder spring.
4—Engine oil pressure.

**9531.** What keeps the reversing hydromatic propeller in reverse?

1—Spring pressure.
2—Auxiliary pump.
3—Governor high pressure relief valve.
4—Governor oil pressure.

**9532.** The feather valve of a reversing propeller may be hydraulically activated automatically by

1—the propeller springs forcing oil out of the propeller.
2—a loss of torque sensed by the negative torque sensing (NTS) system.
3—propeller counterweights forcing the oil out of the propeller and the blades to the feather angle.
4—throttle reductions one engine at a time.

**9533.** Which propeller ice elimination system is ineffective once the ice has formed?

1—Electrically heated rubber boots.
2—Pneumatic boots.
3—Ducted engine heat.
4—Isopropyl alcohol fluid.

**9534.** What is the purpose of a rheostat in the anti-icing system?

1—Determine the temperature of the boots.
2—Cycle the heating coils on and off.
3—Provide correct boot expansion pressure.
4—Control the rate of fluid flow.

**9535.** In which propeller ice elimination system will the slinger ring be found?

1—Fluid anti-ice.
2—Electrically heated boots.
3—Pneumatic boots.
4—Ducted heat.

**9536.** What is the purpose of the "full deice" mode toggle switch in a propeller deicing system?

1—Provide full fluid flow to the propellers.
2—Distribute maximum pneumatic pressure to the boots.
3—Deice all propellers at the same time.
4—Allow maximum current flow to the blade heating coils.

**9537.** As applies to electric propeller deicing systems, which is correct?

1—During normal operation, all propellers are deiced at the same time.
2—Electric current is directed to all propellers equally and at specified intervals.
3—During normal operation, only one propeller at a time is deiced.
4—A sensor in each nacelle sequences deicing to each propeller as needed by sensing ice buildup.

**9538.** What components are used to transfer electrical power from the engine nose case to the propeller in a deicing system?

1—Slinger ring and tubes.
2—Rheostat and reverse current relay.
3—Brush block and slip ring.
4—Sequence motor and timer.

**9539.** In the timing sequence of a deicing timer, why is a null period included?

1—Deice more than one propeller at a time.
2—Deice all blades on all engines at the same time.
3—Prevent more than one blade being deiced at any one time.
4—Prevent more than one propeller from being deiced at any one time.

**9540.** During the null period, which is correct?

1—No blades are being deiced and the loadmeter indicates zero.
2—One propeller only is being deiced and the loadmeter indicates the appropriate current flow.
3—All propellers are being deiced and the loadmeter indicates the appropriate current flow.
4—No blades are being deiced and the loadmeter indicates generator current flow.

**9541.** What is the typical heating sequence time for each propeller of an electrically deiced system?

1—30 seconds.
2—60 seconds.
3—90 seconds.
4—120 seconds.

**9542.** What is the purpose of the engine master control system?

1—Allow the pilot to select any engine as the master engine.
2—Synchronize all engine speeds to the master engine.
3—Change all throttles at the same time through one lever.
4—Change all RPM settings of all governors through one lever.

**9543.** The ability to cause all governors to drive to their high RPM stop through the use of one lever is known as

1—calibrating.
2—synchronizing.
3—sequencing.
4—slaving.

**9544.** To synchronize properly, the engine synchronization system requires that slave engines must be within about

1—100 RPM of the master engine.
2—100 RPM of each other.
3—100 RPM of the calibrated engine.
4—50 RPM of the propeller governing range.

**9545.** What is the purpose of the resynchronization button?

1—Allow repeated attempts to synchronize all engines.
2—Provide full range of travel to all slave engines.
3—Allow a change of speed of the master engine.
4—Bring all engines into synchronization at one time.

**9546.** What is synchrophasing?

1—Provides adjustment of RPM to match harmonically.
2—Sets the slave engine blades to trail a number of degrees behind the master engine blades.
3—Sets all blade angles and RPM to match the master engine.
4—Allows different RPM settings to be used with similar blade angles for better noise and vibration control.

**9547.** When the autofeather system is armed, what indication appears on the flight engineer's panel?

1—Red indicator light.
2—Blue indicator light.
3—Yellow indicator light.
4—Green indicator light.

**9548.** What affect, if any, does the activation of the autofeather mode have upon the use of the feathering button?

1—Feather button circuitry is shut down with activation of the autofeather circuit.
2—The feather button cannot be used as long as the autofeather system is energized.
3—Any engine can be feathered by pushing the feather button.
4—A blocking relay prevents the feather button from operation during autofeather mode.

**9549.** Why is a blocking relay built into the autofeathering system?

1—To bypass the system while the weight of the airplane is on the landing gear.
2—Prevent the autofeather from activating during takeoff and landing.
3—Prevent more than one engine from autofeathering.
4—Disconnect the feathering button from interfering with the autofeather mode.

**9550.** What is the purpose of the pitch lock mechanism?

1—Prevent excessive engine overspeed in the event of governor failure.
2—Establish the minimum propeller governing speed.
3—Prevent accidental propeller reversing in flight.
4—Maintain constant present propeller RPM.

**9551.** Where does the integrated oil control assembly (IOCA) obtain its operating oil?

1—From the engine oil sump or hopper.
2—Carries its own oil supply in a main sump.
3—Taps oil from the high pressure side of the governor.
4—Uses propeller dome oil as a reservoir.

**9552.** If the integrated oil control assembly (IOCA) primary oil supply becomes depleted, what would be the first indication?

1—An indicator light will come on in the cockpit.
2—Bootstrapping of the manifold pressure.
3—The affected propeller will not remain synchronized.
4—The autofeather system cannot be engaged.

**9553.** As applies to propellers, what does the term "hydromatic" mean?

1—The installation contains a water injection system.
2—Propeller pitch changes are done automatically through the throttle movement.
3—A trade name for a Hamilton-Standard propeller.
4—The name given to any hydraulically operated propeller.

**9554.** For flight operations at cruising speeds less than 250 MPH, which powerplant would be the most desirable?

1—Turbojet.
2—Turbofan.
3—Turboprop.
4—Reciprocating.

**9555.** Which class of powerplant would be the most efficient for aircraft operating at cruise speeds in the 250 to 450 MPH range?

1—Reciprocating.
2—Turboprop.
3—Turbojet.
4—Turbofan.

**9556.** Which engine boasts the lowest fuel consumption rate of the various gas-turbine engines?

1—High bypass turbofan.
2—Medium bypass turbofan.
3—Dual-spool axial flow turbojet.
4—Axial flow turboprop.

**9557.** Which gas turbine is most like the turboshaft?

1—Turboprop.
2—Turbofan.
3—Axial flow turbojet.
4—Centrifugal flow turbojet.

**9558.** The speed of sound is variable according to a change in

1—temperature and pressure.
2—temperature and humidity.
3—temperature only.
4—pressure only.

**9559.** The fan blade speed in an axial flow compressor is kept just below the speed of sound to prevent

1—blade fracture.
2—sonic boom.
3—overtemp conditions.
4—shock stall.

**9560.** In newer jet aircraft, how is noise suppression accomplished?

1—By design, newer jet engines do not need suppression.
2—Variable vane tailpipe ducts.
3—Inlets and tailpipes lined with noise attenuating material.
4—Development of smaller, more efficient compressors which arrive at the speed of sound at higher speed.

**9561.** Define thrust specific fuel consumption (TSFC)?

1—Total fuel consumed from takeoff to landing during high idle operations.
2—Pounds of fuel consumed to produce 1 pound of thrust in 1 hour.
3—Comparison ratio between single and dual-spool axial flow compressors compared to other turbines.
4—Fuel burned versus fuel remaining, following the subtraction of driftdown computations.

**9562.** On the dual axial compressor gas turbine, the starter rotates

1—the low speed compressor only.
2—the high speed compressor only.
3—both the high and low speed compressors.
4—both the high and low speed turbines.

**9563.** Which starter is used almost exclusively on commercial aircraft?

1—Impingement starter.
2—Air turbine starter.
3—Fuel-air combustion starter.
4—High intensity battery cart.

**9564.** Which is the main advantage of a high voltage a.c. input system?

1—More compatible with lighting and appliances.
2—Better extreme climate reliability.
3—Lower weight factor with the absence of the trigger transformer and capacitor.
4—Receives its power direct from the battery bus.

**9565.** Select the indicator that does not require bus power to operate?

1—Autosyn oil pressure indicator.
2—Thermocouple oil temperature indicator.
3—Torquemeter.
4—Fuel pressure indicator.

**9566.** Which turbojet indicator has no limiting gauge markings?

1—Tachometer.
2—Exhaust gas temperature.
3—Torque indicator.
4—Thrust indicator.

**9567.** Propulsive efficiency is defined as

1—external engine efficiency.
2—internal engine efficiency.
3—fuel consumption efficiency.
4—thrust efficiency.

**9568.** Which gas turbine was the first to be developed?

1—Turbofan.
2—Turboshaft.
3—Turboprop.
4—Turbojet.

**9569.** Kinetic energy is an energy of

1—motion.
2—pressure.
3—work.
4—thrust.

**9570.** Another name for static thrust is

1—thrust horsepower.
2—net thrust.
3—gross thrust.
4—ambient thrust.

**9571.** Air exiting a convergent nozzle in a choked condition will have a velocity that is

1—directly proportional to its size.
2—inversely proportional to its size.
3—at the speed of sound.
4—well beyond the speed of sound.

**9572.** Which factor most affects thrust?

1—Ambient temperature.
2—Altitude density.
3—Compressor efficiency at altitude.
4—Turbine efficiency at altitude.

**9573.** The RPM of axial flow compressors is primarily limited by

1—tip speed.
2—compression ratio.
3—turbine inlet temperature.
4—Gravity (G) forces.

**9574.** What vector forces within an axial flow compressor most influence a stall condition?

1—Compressor speed and air velocity.
2—Compression ratio and compressor speed.
3—Compressor speed and RPM.
4—Inlet air velocity and compression ratio.

**9575.** Which fuel control unit operates by fluid servos and mechanical forces?

1—Constant pressure fuel control.
2—Pressure controlled fuel control.
3—Mechanical fuel control.
4—Hydromechanical fuel control.

**9576.** Flat-rated engines are designed to maintain rated thrust to a value above which standard day condition?

1—Pressure.
2—Temperature.
3—Exhaust pressure ratio (EPR).
4—Altitude.

**9577.** How does the variable compressor stator vane system control the stall margin of turbine engines?

1—Reduces airflow into the engine at low power settings.
2—Reduces airflow into the engine at high power settings.
3—Reduces fuel flow into the engine at high power settings.
4—Dumps unwanted air overboard.

**9578.** The compressor bleed system is scheduled open to prevent compressor stalls during

1—high engine speeds.
2—flight at altitude.
3—low and intermediate engine speeds.
4—ground operation.

**9579.** Turbine anti-ice systems are designed to

1—remove ice formation from the inlet.
2—prevent ice formation in the inlet.
3—operate only at altitude.
4—operate only during ground operations.

# APPENDIX 1

# DEPARTMENT OF TRANSPORTATION

# FEDERAL AVIATION ADMINISTRATION

## SUBJECT MATTER KNOWLEDGE CODES

To determine the knowledge area in which a particular question was incorrectly answered, compare the subject matter knowledge code(s) onAC Form 8080-2, Airmen Written Test Report, to the subject matter knowledge codes that follow. The total number of questions missed may differ from the number of subject matter knowledge codes shown on the AC Form 8080-2, since you may have missed more than one question in a certain subject matter knowledge code.

| | |
|---|---|
| **FAR 1** | **Definitions and Abbreviations** |
| A01 | General Definitions |
| A02 | Abbreviations and Symbols |
| **FAR 23** | **Airworthiness Standards: Normal, Utility, and Acrobatic Category Aircraft** |
| A10 | General |
| **FAR 43** | **Maintenance, Preventive Maintenance, Rebuilding and Alteration** |
| A15 | General |
| A16 | Appendixes |
| **FAR 61** | **Certification: Pilots and Flight Instructors** |
| A20 | General |
| A21 | Aircraft Ratings and Special Certificates |
| A22 | Student Pilots |
| A23 | Private Pilots |
| A24 | Commercial Pilots |
| A25 | Airline Transport Pilots |
| A26 | Flight Instructors |
| A27 | Appendix A: Practical Test Requirements for Airline Transport Pilot Certificates and Associated Class and Type Ratings |
| A28 | Appendix B: Practical Test Requirements for Rotorcraft Airline Transport Pilot Certificates with a Helicopter Class Rating and Associated Type Ratings |
| **FAR 63** | **Certification: Flight Crewmembers Other Than Pilots** |
| A30 | General |
| A31 | Flight Engineers |
| A32 | Flight Navigators |
| **FAR 65** | **Certification: Airmen Other Than Flight Crewmembers** |
| A40 | General |
| A41 | Aircraft Dispatchers |
| **FAR 67** | **Medical Standards and Certification** |
| A50 | General |
| A51 | Certification Procedures |
| **FAR 71** | **Designation of Federal Airways, Area Low Routes, Controlled Airspace, and Reporting Points** |
| A60 | General |
| A61 | Airport Radar Service Areas |
| **FAR 73** | **Special Use Airspace** |
| A70 | General |
| A71 | Restricted Areas |
| A72 | Prohibited Areas |
| **FAR 75** | **Establishment of Jet Routes and Area High Routes** |
| A80 | General |
| **FAR 77** | **Objects Affecting Navigable Airspace** |
| A90 | General |
| **FAR 91** | **General Operating Rules** |
| B01 | General |
| B02 | Flight Rules |
| B03 | Maintenance, Preventive Maintenance, and Alterations |
| B04 | Large and Turbine-Powered Multiengine Airplanes |
| B05 | Operating Noise Limits |
| B06 | Appendix A: Category II Operations Manual, Instruments, Equipment, and Maintenance |
| **FAR 103** | **Ultralight Vehicles** |
| C01 | General |
| C02 | Operating Rules |
| **FAR 108** | **Airplane Operator Security** |
| C10 | General |
| **FAR 121** | **Certification and Operations: Domestic, Flag and Supplemental Air Carriers and Commercial Operators of Large Aircraft** |
| D01 | General |
| D02 | Certification Rules for Domestic and Flag Air Carriers |
| D03 | Certification Rules for Supplemental Air Carriers and Commercial Operators |

## Appendix 1

| | |
|---|---|
| D04 | Rules Governing all Certificate Holders Under This Part |
| D05 | Approval of Routes: Domestic and Flag Air Carriers |
| D06 | Approval of Areas and Routes for Supplemental Air Carriers and Commercial Operators |
| D07 | Manual Requirements |
| D08 | Aircraft Requirements |
| D09 | Airplane Performance Operating Limitations |
| D10 | Special Airworthiness Requirements |
| D11 | Instrument and Equipment Requirements |
| D12 | Maintenance, Preventive Maintenance, and Alterations |
| D13 | Airman and Crewmember Requirements |
| D14 | Training Program |
| D15 | Crewmember Qualifications |
| D16 | Aircraft Dispatcher Qualifications and Duty Time Limitations: Domestic and Flag Air Carriers |
| D17 | Flight Time Limitations and Rest Requirements: Domestic Air Carriers |
| D18 | Flight Time Limitations: Flag Air Carriers |
| D19 | Flight Time Limitations: Supplemental Air Carriers and Commercial Operators |
| D20 | Flight Operations |
| D21 | Dispatching and Flight Release Rules |
| D22 | Records and Reports |
| D23 | Crewmember Certificate: International |
| D24 | Special Federal Aviation Regulation SFAR No. 14 |

**FAR 125** **Certification and Operations: Airplanes Having a Seating Capacity of 20 or More Passengers or a Maximum Payload Capacity of 6,000 Pounds or More**

| | |
|---|---|
| D30 | General |
| D31 | Certification Rules and Miscellaneous Requirements |
| D32 | Manual Requirements |
| D33 | Airplane Requirements |
| D34 | Special Airworthiness Requirements |
| D35 | Instrument and Equipment Requirements |
| D36 | Maintenance |
| D37 | Airman and Crewmember Requirements |
| D38 | Flight Crewmember Requirements |
| D39 | Flight Operations |
| D40 | Flight Release Rules |
| D41 | Records and Reports |

**FAR 135** **Air Taxi Operators and Commercial Operators**

| | |
|---|---|
| E01 | General |
| E02 | Flight Operations |
| E03 | Aircraft and Equipment |
| E04 | VFR/IFR Operating Limitations and Weather Requirements |
| E05 | Flight Crewmember Requirements |
| E06 | Flight Crewmember Flight Time Limitations and Rest Requirements |
| E07 | Crewmember Testing Requirements |
| E08 | Training |
| E09 | Airplane Performance Operating Limitations |
| E10 | Maintenance, Preventive Maintenance, and Alterations |
| E11 | Appendix A: Additional Airworthiness Standards for 10 or More Passenger Airplanes |
| E12 | Special Federal Aviation Regulations SFAR No. 36 |
| E13 | Special Federal Aviation Regulations SFAR No. 38 |

**FAR 143** **Certification: Ground Instructors**

| | |
|---|---|
| F01 | General |

**US HMR 172** **Hazardous Materials Table**

| | |
|---|---|
| F02 | General |

**US HMR 175** **Materials Transportation Bureau Hazardous Materials Regulations (HMR)**

| | |
|---|---|
| G01 | General Information and Regulations |
| G02 | Loading, Unloading, and Handling |
| G03 | Specific Regulation Applicable According to Classification of Material |

**NTSB 830** **Rules Pertaining to the Notification and Reporting of Aircraft Accidents or Incidents and Overdue Aircraft, and Preservation of Aircraft Wreckage, Mail, Cargo, and Records**

| | |
|---|---|
| G10 | General |
| G11 | Initial Notification of Aircraft Accidents, Incidents, and Overdue Aircraft |
| G12 | Preservation of Aircraft Wreckage, Mail, Cargo, and Records |
| G13 | Reporting of Aircraft Accidents, Incidents, and Overdue Aircraft |

**AC 61-23** **Pilot's Handbook of Aeronautical Knowledge**

| | |
|---|---|
| H01 | Principles of Flight |
| H02 | Airplanes and Engines |
| H03 | Flight Instruments |
| H04 | Airplane Performance |
| H05 | Weather |
| H06 | Basic Calculations Using Navigational Computers or Electronic Calculators |
| H07 | Navigation |
| H08 | Flight Information Publications |
| H09 | Appendix 1: Obtaining FAA Publications |

**AC 91-23** **Pilot's Weight and Balance Handbook**

| | |
|---|---|
| H10 | Weight and Balance Control |
| H11 | Terms and Definitions |
| H12 | Empty Weight Center of Gravity |
| H13 | Index and Graphic Limits |
| H14 | Change of Weight |
| H15 | Control of Loading - General Aviation |
| H16 | Control of Loading - Large Aircraft |

**AC 60-14 Aviation Instructor's Handbook**

| | |
|---|---|
| H20 | The Learning Process |
| H21 | Human Behavior |
| H22 | Effective Communication |
| H23 | The Teaching Process |
| H24 | Teaching Methods |
| H25 | The Instructor as a Critic |
| H26 | Evaluation |
| H27 | Instructional Aids |
| H30 | Flight Instructor Characteristics and Responsibilities |
| H31 | Techniques of Flight Instruction |
| H32 | Planning Instructional Activity |
| H40 | Aircraft Maintenance Instructor Characteristics and Responsibilities |
| H41 | Integrated Job Training |
| H42 | Planning Aircraft Maintenance Instructional Activities |
| H43 | Appendix |

**AC 61-21 Flight Training Handbook**

| | |
|---|---|
| H50 | Introduction to Flight Training |
| H51 | Introduction to Airplanes and Engines |
| H52 | Introduction to the Basics of Flight |
| H53 | The Effect and Use of Controls |
| H54 | Ground Operations |
| H55 | Basic Flight Maneuvers |
| H56 | Airport Traffic Patterns and Operations |
| H57 | Takeoffs and Departure Climbs |
| H58 | Landing Approaches and Landings |
| H59 | Faulty Approaches and Landings |
| H60 | Proficiency Flight Maneuvers |
| H61 | Cross-Country Flying |
| H62 | Emergency Flight by Reference to Instruments |
| H63 | Night Flying |
| H64 | Seaplane Operations |
| H65 | Transition to Other Airplanes |
| H66 | Principles of Flight and Performance Characteristics |

**AC 61-13 Basic Helicopter Handbook**

| | |
|---|---|
| H70 | General Aerodynamics |
| H71 | Aerodynamics of Flight |
| H72 | Loads and Load Factors |
| H73 | Function of the Controls |
| H74 | Other Helicopter Components and Their Functions |
| H75 | Introduction to the Helicopter Flight Manual |
| H76 | Weight and Balance |
| H77 | Helicopter Performance |
| H78 | Some Hazards of Helicopter Flight |
| H79 | Precautionary Measures and Critical Conditions |
| H80 | Helicopter Flight Maneuvers |
| H81 | Confined Area, Pinnacle, and Ridgeline Operations |
| H82 | Glossary |

**Gyroplane Flight Training Manual**

| | |
|---|---|
| H90 | Gyroplane Systems |
| H91 | Gyroplane Terms |
| H92 | Use of Flight Controls (Gyroplane) |
| H93 | Fundamental Maneuvers of Flight (Gyroplane) |
| H94 | Basic Flight Maneuvers (Gyroplane) |

**AC 61-27 Instrument Flying Handbook**

| | |
|---|---|
| I01 | Training Considerations |
| I02 | Instrument Flying: Coping With Illusions in Flight |
| I03 | Aerodynamic Factors Related to Instrument Flying |
| I04 | Basic Flight Instruments |
| I05 | Attitude Instrument Flying - Airplanes |
| I06 | Attitude Instrument Flying - Helicopters |
| I07 | Electronic Aids to Instrument Flying |
| I08 | Using the Navigation Instruments |
| I09 | Radio Communications Facilities and Equipment |
| I10 | The Federal Airways System and Controlled Airspace |
| I11 | Air Traffic Control |
| I12 | ATC Operations and Procedures |
| I13 | Flight Planning |
| I14 | Appendix: Instrument Instructor Lesson Guide - Airplanes |
| I15 | Segment of En Route Low Altitude Chart |

**AC 00-6 Aviation Weather**

| | |
|---|---|
| I20 | The Earth's Atmosphere |
| I21 | Temperature |
| I22 | Atmospheric Pressure and Altimetry |
| I23 | Wind |
| I24 | Moisture, Cloud Formation, and Precipitation |
| I25 | Stable and Unstable Air |
| I26 | Clouds |
| I27 | Air Masses and Fronts |
| I28 | Turbulence |
| I29 | Icing |
| I30 | Thunderstorms |
| I31 | Common IFR Producers |
| I32 | High Altitude Weather |
| I33 | Arctic Weather |
| I34 | Tropical Weather |
| I35 | Soaring Weather |
| I36 | Glossary of Weather Terms |

**AC 00-45 Aviation Weather Services**

| | |
|---|---|
| I40 | The Aviation Weather Service Program |
| I41 | Surface Aviation Weather Reports |
| I42 | Pilot and Radar Reports and Satellite Pictures |
| I43 | Aviation Weather Forecasts |
| I44 | Surface Analysis Chart |
| I45 | Weather Depiction Chart |
| I46 | Radar Summary Chart |
| I47 | Significant Weather Prognostics |
| I48 | Winds and Temperatures Aloft |

## Appendix 1

| | |
|---|---|
| I49 | Composite Moisture Stability Chart |
| I50 | Severe Weather Outlook Chart |
| I51 | Constant Pressure Charts |
| I52 | Tropopause Data Chart |
| I53 | Tables and Conversion Graphs |

**AIM — Airman's Information Manual**

| | |
|---|---|
| J01 | Air Navigation Radio Aids |
| J02 | Radar Services and Procedures |
| J03 | Airport Lighting Aids |
| J04 | Air Navigation and Obstruction Lighting |
| J05 | Airport Marking Aids |
| J06 | Airspace - General |
| J07 | Uncontrolled Airspace |
| J08 | Controlled Airspace |
| J09 | Special Use Airspace |
| J10 | Other Airspace Areas |
| J11 | Service Available to Pilots |
| J12 | Radio Communications Phraseology and Techniques |
| J13 | Airport Operations |
| J14 | ATC Clearance/Separations |
| J15 | Preflight |
| J16 | Departure Procedures |
| J17 | En Route Procedures |
| J18 | Arrival Procedures |
| J19 | Pilot/Controller Roles and Responsibilities |
| J20 | National Security and Interception Procedures |
| J21 | Emergency Procedures - General |
| J22 | Emergency Services Available to Pilots |
| J23 | Distress and Urgency Procedures |
| J24 | Two-Way Radio Communications Failure |
| J25 | Meteorology |
| J26 | Altimeter Setting Procedures |
| J27 | Wake Turbulence |
| J28 | Bird Hazards, and Flight Over National Refuges, Parks, and Forests |
| J29 | Potential Flight Hazards |
| J30 | Safety, Accident, and Hazard Reports |
| J31 | Fitness for Flight |
| J32 | Type of Charts Available |
| J33 | Pilot Controller Glossary |
| J34 | Airport/Facility Directory |
| J35 | En Route Low Altitude Chart |
| J36 | En Route High Altitude Chart |
| J37 | Sectional Chart |
| J38 | WAC Chart |
| J39 | Terminal Area Chart |
| J40 | Standard Instrument Departure (SID) Chart |
| J41 | Standard Terminal Arrival (STAR) Chart |
| J42 | Instrument Approach Procedures |

**AC 67-2 — Medical Handbook for Pilots**

| | |
|---|---|
| J50 | The Flyer's Environment |
| J51 | The Pressure is On |
| J52 | Hypoxia |
| J53 | Hyperventilation |
| J54 | The Gas in the Body |
| J55 | The Ears |
| J56 | Alcohol |
| J57 | Drugs and Flying |
| J58 | Carbon Monoxide |
| J59 | Vision |
| J60 | Night Flight |
| J61 | Cockpit Lighting |
| J62 | Disorientation (Vertigo) |
| J63 | Motion Sickness |
| J64 | Fatigue |
| J65 | Noise |
| J66 | Age |
| J67 | Some Psychological Aspects of Flying |
| J68 | The Flying Passenger |

**ADDITIONAL ADVISORY CIRCULARS**

| | |
|---|---|
| K01 | AC 00-24, Thunderstorms |
| K02 | AC 00-30, Rules of Thumb for Avoiding or Minimizing Encounters With Clear Air Turbulence |
| K03 | AC 00-34, Aircraft Ground Handling and Servicing |
| K04 | AC 00-50, Low Level Wind Shear |
| K10 | AC 20-5, Plane Sense |
| K11 | AC 20-29, Use of Aircraft Fuel Anti-Icing Additives |
| K12 | AC 20-32, Carbon Monoxide (CO) Contamination in Aircraft - Detection and Prevention |
| K13 | AC 20-43, Aircraft Fuel Control |
| K14 | AC 20-64, Maintenance Inspection Notes for Lockheed L-188 Series Aircraft |
| K15 | AC 20-76, Maintenance Inspection Notes for Boeing B-707/720 Series Aircraft |
| K16 | AC 20-78, Maintenance Inspection Notes for McDonnell Douglas DC-8 Series Aircraft |
| K17 | AC 20-84, Maintenance Inspection Notes for Boeing B-727 Series Aircraft |
| K18 | AC 20-99, Antiskid and Associated Systems |
| K19 | AC 20-101, Omega and Omega/VLF Navigation Systems Approvals for Use in the Conterminous United States and Alaska |
| K20 | AC 20-103, Aircraft Engine Crankshaft Failure |
| K21 | AC 20-106, Aircraft Inspection for the General Aviation Aircraft Owner |
| K22 | AC 20-113, Pilot Precautions and Procedures to be Taken in Preventing Aircraft Reciprocating Engine Induction System and Fuel System Icing Problems |
| K23 | AC 20-121, Airworthiness Approval of Airborne Loran-C Systems for Use in the U.S. National Airspace System |
| K24 | AC 20-125, Water in Aviation Fuels |
| K30 | AC 23.679-1, Control System Locks |
| K31 | AC 23.1521-1, Approval of Automobile Gasoline (Autogas) in Lieu of Aviation Gasoline (Avgas) in Small Airplanes With Reciprocating Engines |
| K40 | AC 25-4, Inertial Navigation Systems (INS) |
| K41 | AC 25.253-1, High-Speed Characteristics |
| K50 | AC 29-2, Certification of Transportation Category Rotorcraft |
| K60 | AC 33.65-1, Surge and Stall Characteristics of Aircraft Turbine Engines |
| K70 | AC 43-9, Maintenance Records |

| | |
|---|---|
| K71 | AC 43-12, Preventive Maintenance |
| K80 | AC 60-4, Pilot's Spatial Disorientation |
| K81 | AC 60-6, Airplane Flight Manuals (AFM), Approved Manual Materials, Markings, and Placards - Airplanes |
| K90 | AC 60-12, Availability of Industry-Developed Guidelines for the Conduct of the Biennial Flight Review |
| L01 | AC 61-9, Pilot Transition Courses for Complex Single Engine and Light, Twin-Engine Airplanes |
| L02 | AC 61-10, Private and Commercial Pilots Refresher Courses |
| L03 | AC 61-12, Student Pilot Guide |
| L04 | AC 61-47, Use of Approach Slope Indicators for Pilot Training |
| L05 | AC 61-65, Certification: Pilot and Flight Instructors |
| L06 | AC 61-66, Annual Pilot In Command Proficiency Checks |
| L07 | AC 61-67, Hazards Associated with Spins in Airplanes Prohibited from Intentional Spinning |
| L08 | AC 61-84, Role of Preflight Preparation |
| L09 | AC 61-89, Pilot Certificates: Aircraft Type Ratings |
| L10 | AC 61-92, Use of Distractions During Pilot Certification Flight Tests |
| L11 | AC 61-94, Pilot Transition Course for Self-Launching or Powered Sailplanes (Motorgliders) |
| L20 | AC 67-1, Medical Information for Air Ambulance Operators |
| L30 | AC 90-23, Aircraft Wake Turbulence |
| L31 | AC 90-34, Accidents Resulting from Wheelbarrowing in Tricycle Gear Equipped Aircraft |
| L32 | AC 90-42, Traffic Advisory Practices at Nontower Airports |
| L33 | AC 90-45, Approval of Area Navigation Systems for Use in the U.S. National Airspace System |
| L34 | AC 90-48, Pilots' Role in Collision Avoidance |
| L35 | AC 90-58, VOR Course Errors Resulting from 50 kHz Channel Mis-Selection |
| L36 | AC 90-66, Recommended Standard Traffic Patterns for Airplane Operations at Uncontrolled Airports |
| L37 | AC 90-67, Light Signals from the Control Tower for Ground Vehicles, Equipment, and Personnel |
| L38 | AC 90-79, Recommended Practices and Procedures for the Use of Electronic Long Range Navigation Equipment |
| L39 | AC 90-82, Random Area Navigation Routes |
| L40 | AC 90-83, Terminal Control Areas (TCA) |
| L41 | AC 90-85, Severe Weather Avoidance Plan (SWAP) |
| L42 | AC 90-87, Helicopter Dynamic Rollover |
| L43 | AC 90-88, Airport Radar Service Area (ARSA) |
| L50 | AC 91-6, Water, Slush, and Snow on the Runway |
| L51 | AC 91-8, Use of Oxygen by Aviation Pilots/Passengers |
| L52 | AC 91-13, Cold Weather Operation of Aircraft |
| L53 | AC 91-14, Altimeter Setting Sources |
| L54 | AC 91-16, Category II Operations - General Aviation Airplanes |
| L55 | AC 91-32, Safety In and Around Helicopters |
| L56 | AC 91-42, Hazards of Rotating Propeller and Helicopter Rotor Blades |
| L57 | AC 91-43, Unreliable Airspeed Indications |
| L58 | AC 91-44, Operational and Maintenance Practices for Emergency Locator Transmitters and Receivers |
| L59 | AC 91-46, Gyroscopic Instruments - Good Operating Practices |
| L60 | AC 91-49, General Aviation Procedures for Flight in North Atlantic Minimum Navigation Performance Specifications Airspace |
| L61 | AC 91-50, Importance of Transponder Operation and Altitude Reporting |
| L62 | AC 91-51, Airplane Deice and Anti-Ice Systems |
| L63 | AC 91-53, Noise Abatement Departure Profile |
| L64 | AC 91-55, Reduction of Electrical System Failures Following Aircraft Engine Starting |
| L65 | AC 91-58, Use of Pyrotechnic Visual Distress Signaling Devices in Aviation |
| L66 | AC 91-64, Use of Remote Altimeter Settings Instrument Approach Procedures |
| L67 | AC 91-83, Canceling or Closing Flight Plans |
| L70 | AC 97-1, Runway Visual Range (RVR) |
| L80 | AC 103-4, Hazard Associated with Sublimation of Solid Carbon Dioxide (Dry Ice) Aboard Aircraft |
| L81 | AC 103-6, Ultralight Vehicle Operations - Airports, ATC, and Weather |
| L82 | AC 103-7, The Ultralight Vehicle |
| M01 | AC 120-12, Private Carriage Versus Common Carriage of Persons or Property |
| M02 | AC 120-27, Aircraft Weight and Balance Control |
| M03 | AC 120-29, Criteria for Approving Category I and Category II Landing Minima for FAR 121 Operators |
| M04 | AC 120-32, Air Transportation of Handicapped Persons |
| M10 | AC 121-6, Portable Battery-Powered Megaphones |
| M11 | AC 121-24, Passenger Safety Information Briefing and Briefing Cards |
| M12 | AC 121-25, Additional Weather Information: Domestic and Flag Air Carriers |
| M13 | AC 121-195, Alternate Operational Landing Distances for Wet Runways; Turbojet Powered Transport Category Airplanes |
| M20 | AC 125-1, Operations of Large Airplanes Subject to Federal Aviation Regulations Part 125 |

## Appendix 1

| | |
|---|---|
| M30 | AC 135-3, Air Taxi Operators and Commercial Operators |
| M31 | AC 135-9, FAR Part 135 Icing Limitations |
| M32 | AC 135-12, Passenger Information, FAR Part 135: Passenger Safety Information Briefing and Briefing Cards |
| M40 | AC 150/5345-28, Precision Approach Path Indicator (PAPI) Systems |
| M50 | AC 20-34, Prevention of Retractable Landing Gear Failures |

**American Soaring Handbook - Gliders**

| | |
|---|---|
| N01 | A History of American Soaring |
| N02 | Training |
| N03 | Ground Launch |
| N04 | Airplane Tow |
| N05 | Meteorology |
| N06 | Cross-Country and Wave Soaring |
| N07 | Instruments and Oxygen |
| N08 | Radio, Rope, and Wire |
| N09 | Aerodynamics |
| N10 | Maintenance and Repair |

**Soaring Flight Manual - Gliders**

| | |
|---|---|
| N20 | Sailplane Aerodynamics |
| N21 | Performance Considerations |
| N22 | Flight Instruments |
| N23 | Weather for Soaring |
| N24 | Medical Factors |
| N25 | Flight Publications and Airspace |
| N26 | Aeronautical Charts and Navigation |
| N27 | Computations for Soaring |
| N28 | Personal Equipment |
| N29 | Preflight and Ground Operations |
| N30 | Aerotow Launch Procedures |
| N31 | Ground Launch Procedures |
| N32 | Basic Flight Maneuvers and Traffic Patterns |
| N33 | Soaring Techniques |
| N34 | Cross-Country Soaring |

**Taming The Gentle Giant - Balloons**

| | |
|---|---|
| O01 | Design and Construction of Balloons |
| O02 | Fuel Source and Supply |
| O03 | Weight and Temperature |
| O04 | Flight Instruments |
| O05 | Balloon Flight Tips |
| O06 | Glossary |

**Balloon Federation Of America - Flight Instructor Manual**

| | |
|---|---|
| O10 | Flight Instruction Aids |
| O11 | Human Behavior and Pilot Proficiency |
| O12 | The Flight Check and the Designated Examiner |

**The Balloon Federation Of America Handbook - Propane Systems**

| | |
|---|---|
| O20 | Propane Glossary |
| O21 | Chemical and Physical Systems |
| O22 | Cylinders |
| O23 | Lines and Fittings |
| O24 | Valves |
| O25 | Regulators |
| O26 | Burners |
| O27 | Propane Systems - Schematics |
| O28 | Propane References |

**The Balloon Federation Of America Handbook - Avoiding Powerline Accidents**

| | |
|---|---|
| O30 | Excerpts |

**Balloon Flight Manual**

| | |
|---|---|
| O40 | Excerpts |

**Airship Operations Manual**

| | |
|---|---|
| P01 | Buoyancy |
| P02 | Aerodynamics |
| P03 | Free Ballooning |
| P04 | Aerostatics |
| P05 | Envelope |
| P06 | Car |
| P07 | Powerplant |
| P08 | Airship Ground Handling |
| P09 | Operating Instructions |
| P10 | History |

**International Flight Information Manual**

| | |
|---|---|
| Q01 | Passport and Visa |
| Q02 | International NOTAM Availability and Distribution |
| Q03 | National Security |
| Q04 | International Interception Procedures |
| Q05 | Intercept Pattern for Identification of Transport Aircraft |
| Q06 | Flight Planning Notes |
| Q07 | North Atlantic Minimum Navigation Requirements |
| Q08 | North American Routes for North Atlantic Traffic |
| Q09 | U.S. Aeronautical Telecommunications Services |
| Q10 | Charts and Publications for Flights Outside the U.S. |
| Q11 | Oceanic Long-Range Navigation Information |

**Aerodynamics For Naval Aviators, NAVWEPS 00-80T-80**

| | |
|---|---|
| R01 | Wing and Airfoil Forces |
| R02 | Planform Effects and Airplane Drag |
| R10 | Required Thrust and Power |
| R11 | Available Thrust and Power |
| R12 | Items of Airplane Performance |
| R21 | General Concepts and Supersonic Flow Patterns |
| R22 | Configuration Effects |
| R31 | Definitions |
| R32 | Longitudinal Stability and Control |
| R33 | Directional Stability and Control |
| R34 | Lateral Stability and Control |

| | |
|---|---|
| R35 | Miscellaneous Stability Problems |
| R40 | General Definitions and Structural Requirements |
| R41 | Aircraft Loads and Operating Limitations |
| R50 | Application of Aerodynamics to Specific Problems of Flying |

**AC 65-9 — Airframe and Powerplant Mechanics General Handbook**

| | |
|---|---|
| S01 | Fuels and Fuel Systems |
| S02 | Physics |
| S03 | Basic Electricity |
| S04 | Aircraft Generators and Motors |
| S05 | Starting Engines |
| S06 | Air Conditioning and Heating Units |
| S07 | Ground Support Air Start Units |
| S08 | Aircraft Fueling |
| S09 | Fire |
| S10 | Fire Extinguisher Markings |
| S11 | Aircraft Fire Extinguishers |
| S12 | Engine Intake and Exhaust Hazards |

**AC 65-12 — Airframe and Powerplant Mechanics Powerplant Handbook**

| | |
|---|---|
| S13 | Theory and Construction of Aircraft Engines |
| S14 | Induction and Exhaust Systems |
| S15 | Engine Fuel and Metering Systems |
| S16 | Engine Ignition and Electrical Systems |
| S17 | Engine Starting Systems |
| S18 | Lubrication and Cooling Systems |
| S19 | Propellers |
| S20 | Engine Fire Protection Systems |
| S21 | Engine Maintenance and Operation |

**AC 65-15 — Airframe and Powerplant Mechanics Airframe Handbook**

| | |
|---|---|
| S22 | Aircraft Structures |
| S23 | Aerodynamics |
| S24 | Bernoulli's Principle and Subsonic Flow |
| S25 | Stability and Control |
| S26 | Flight Control Surfaces |
| S27 | High-Speed Aerodynamics |
| S28 | Flight Control Systems |
| S29 | Hydraulic Operated Control Systems |
| S30 | Ice and Rain Protection |
| S31 | Hydraulic and Pneumatic Power Systems |
| S32 | Landing Gear Systems |
| S33 | Fire Protection Systems |
| S34 | Aircraft Electrical Systems |
| S35 | Aircraft Instrument Systems |
| S36 | Cabin Atmosphere Control System |

**EA-ITP-G — Aviation Maintenance Publishers Technical Publications General Section**

| | |
|---|---|
| T01 | Mathematics and Physics |
| T02 | Basic Electricity-DC |
| T03 | Basic Electricity-AC |
| T04 | Ground Handling and Servicing |

**EA-TIP-P — Aviation Maintenance Publishers Technical Publications Powerplant Section**

| | |
|---|---|
| T05 | Reciprocating Engine Theory |
| T06 | Reciprocating Engine Maintenance and Operation |
| T07 | Turbine Engine Theory |
| T08 | Turbine Engine Maintenance and Operation |
| T09 | Engine Ignition Systems |
| T10 | Powerplant Electrical Systems |
| T11 | Powerplant Instrument Systems |
| T12 | Fire Protection Systems |
| T13 | Aircraft Fuel Metering Systems |
| T14 | Emergency and General Signals |
| T15 | Engine Induction Systems |
| T16 | Engine Cooling Systems |
| T17 | Engine Exhaust Systems |
| T18 | Engine Starting Systems |
| T19 | Engine Lubrication Systems |
| T20 | Propellers |

**EA-ITP-A — Aviation Maintenance Publishers Technical Publications Airframe Section**

| | |
|---|---|
| T21 | Structures That Modify Lift |
| T22 | Basic Aerodynamics |
| T23 | Large Multiengine Aircraft Electrical Systems |
| T24 | Aircraft Hydraulic and Pneumatic Power Systems |
| T25 | Landing Gear Systems |
| T26 | Aircraft Cabin Atmospheric Control Systems |
| T27 | Aircraft Pressurization Systems |
| T28 | Aircraft Heaters |
| T29 | Aircraft Air Conditioning Systems |
| T30 | Aircraft Instrument Systems |
| T31 | Communication and Navigation Systems |
| T32 | Position and Warning Systems |
| T33 | Aircraft Fuel Systems |
| T34 | Ice and Rain Control Systems |
| T35 | Fire and Protection Systems |

**EA-TEP-1 — Aviation Maintenance Publishers Technical Publications Aircraft Gas Turbine Powerplants**

| | |
|---|---|
| U01 | History of Engine Development |
| U02 | Jet Propulsion Theory |
| U03 | Turbine Engine Design and Construction |
| U04 | Lubrication Systems |
| U05 | Fuel Systems |
| U06 | Compressor Bleed and Anti-icing Systems |
| U07 | Starter Systems |
| U08 | Ignition Systems |
| U09 | Engine Instrument Systems |
| U10 | Fire Detection Systems |
| U11 | Engine Operations |
| U12 | Glossary |

**EA-ARE — Aviation Maintenance Publishers Technical Publications Aircraft Reciprocating Engines**

| | |
|---|---|
| U13 | Theory and Classification |

| | |
|---|---|
| U14 | Construction and Operation |
| U15 | Engine Troubleshooting |
| U16 | Glossary |

**EA-APC** **Aviation Maintenance Publishers Technical Publications Aircraft Propellers and Controls**

| | |
|---|---|
| U17 | Introduction to Propellers |
| U18 | FAR's and Propellers |
| U19 | Propeller Theory |
| U20 | Automatic Pitch-Changing Propellers |
| U21 | Controllable-Pitch Propellers |
| U22 | Two-Position Propeller Systems |
| U23 | Constant-Speed Propeller Systems |
| U24 | Feathering Propeller Systems |
| U25 | Reversing Propeller Systems |
| U26 | Propeller Auxiliary Systems |
| U27 | Glossary |
| T01 | Reserved |
| U01 | Reserved |
| V01 | Reserved |
| W01 | Reserved |
| X01 | Reserved |
| Y01 | Reserved |
| Z01 | Visual Flight Rules Chart Users Guide |

**NOTE:** Most of the references and study materials listed in these subject matter knowledge codes are available through government outlets such as U.S. Government Printing Office bookstores. AC 00-2, Advisory Circular Checklist, transmits the status of all FAA advisory circulars (AC's), as well as FAA internal publications and miscellaneous flight information such as AIM, Airport/Facility Directory, written test question books, practical test standards, and other material directly related to a certificate or rating. To obtain a free copy of the AC 00-2, send your request to:

U.S. Department of Transportation
Utilization and Storage Section, M-443.2
Washington, DC 20590

# APPENDIX 2

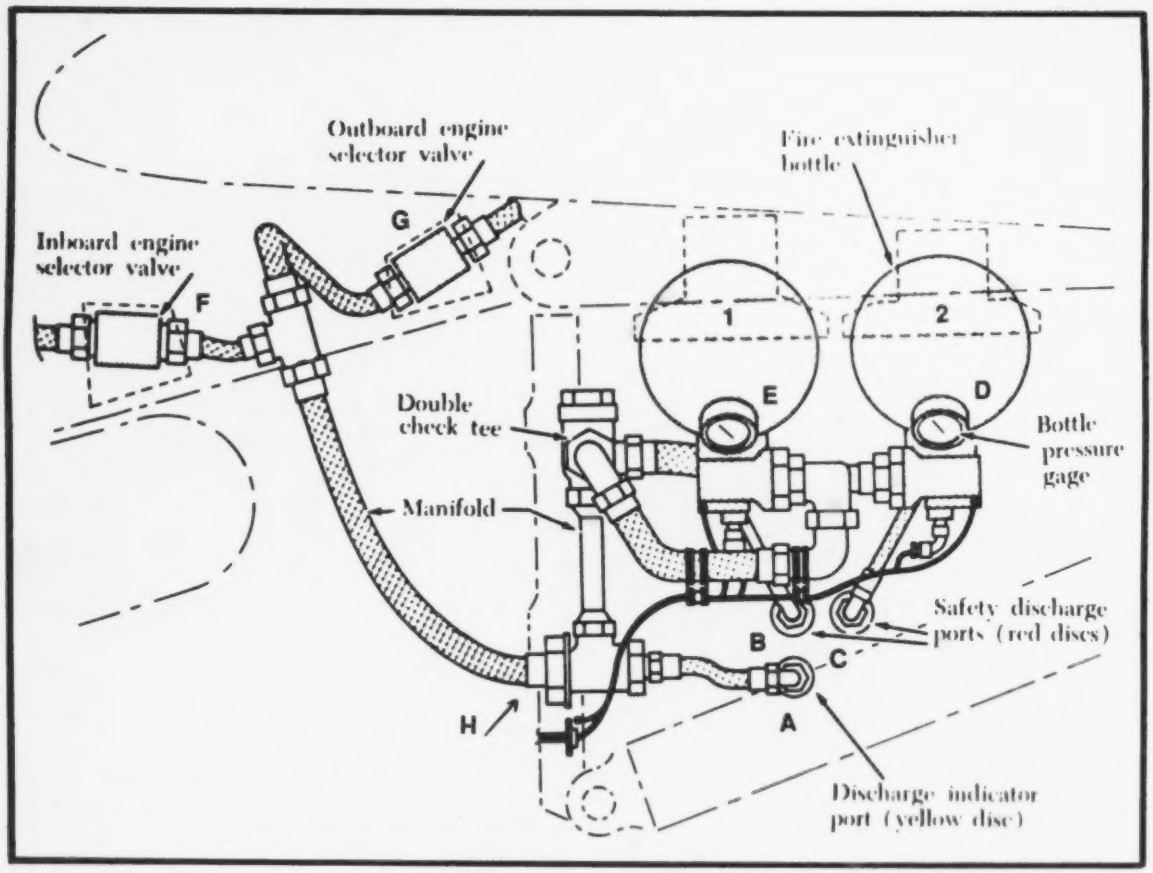



FIGURE 1.—Dual Container Installation.

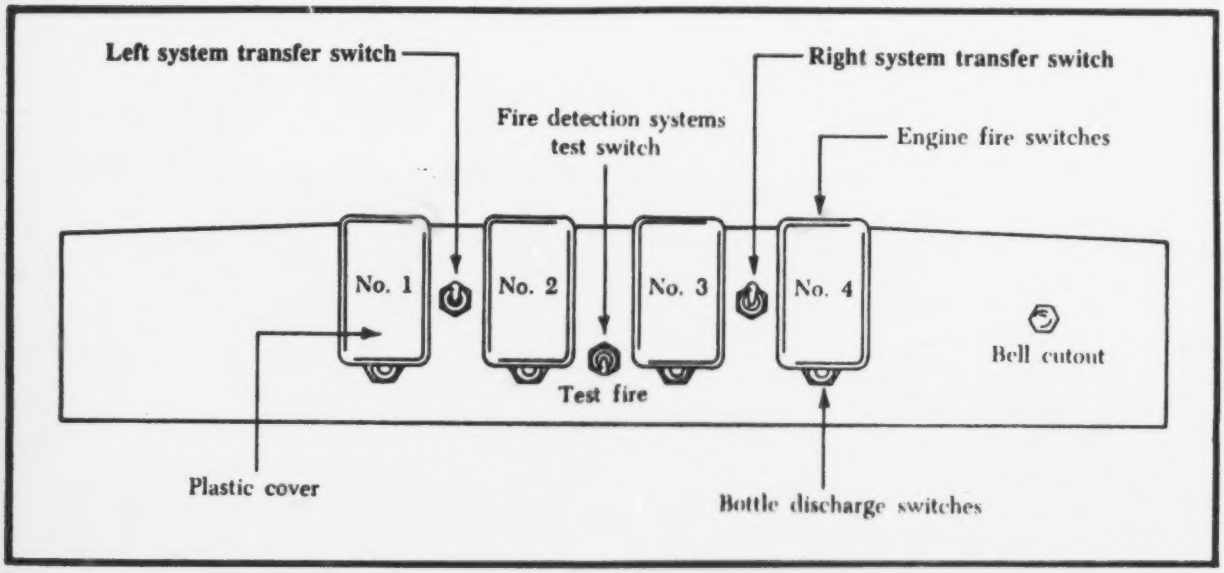



FIGURE 2.—Fire Detection System and Fire Switches.

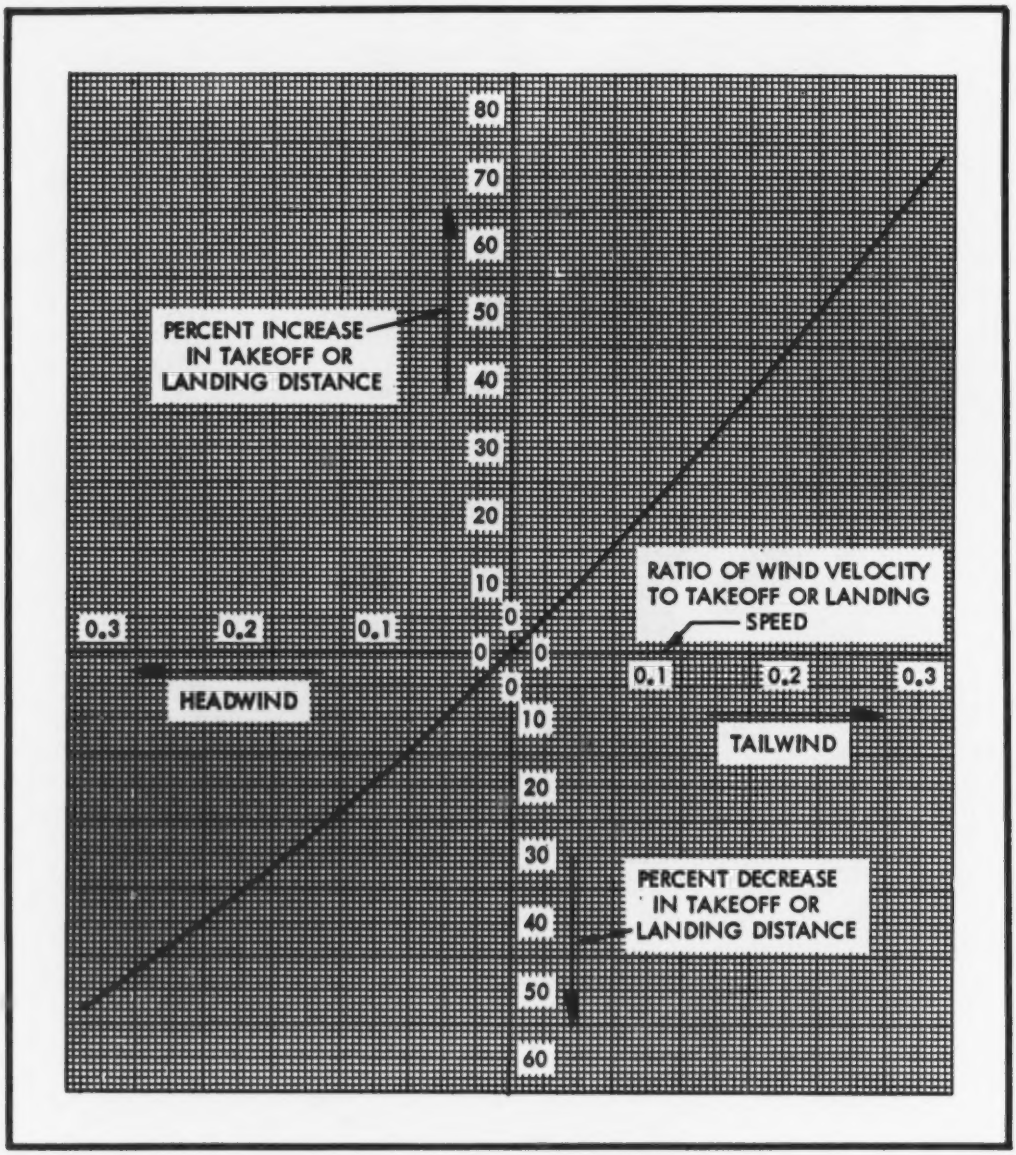



FIGURE 3.—Effect of Wind on Takeoff and Landing.

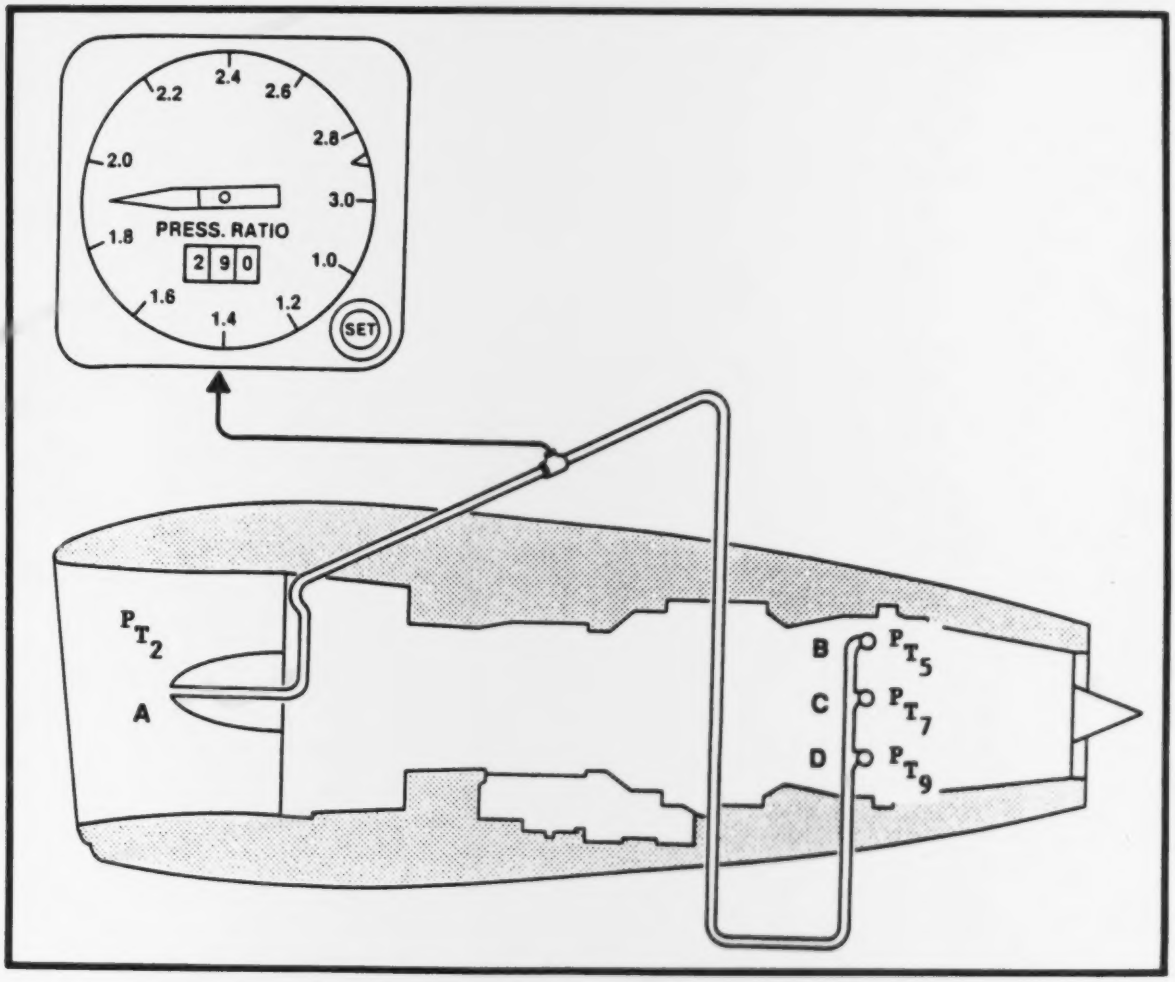



FIGURE 4.—Engine Pressure Ratio Measurement in an Axial-Flow Turbojet Engine.

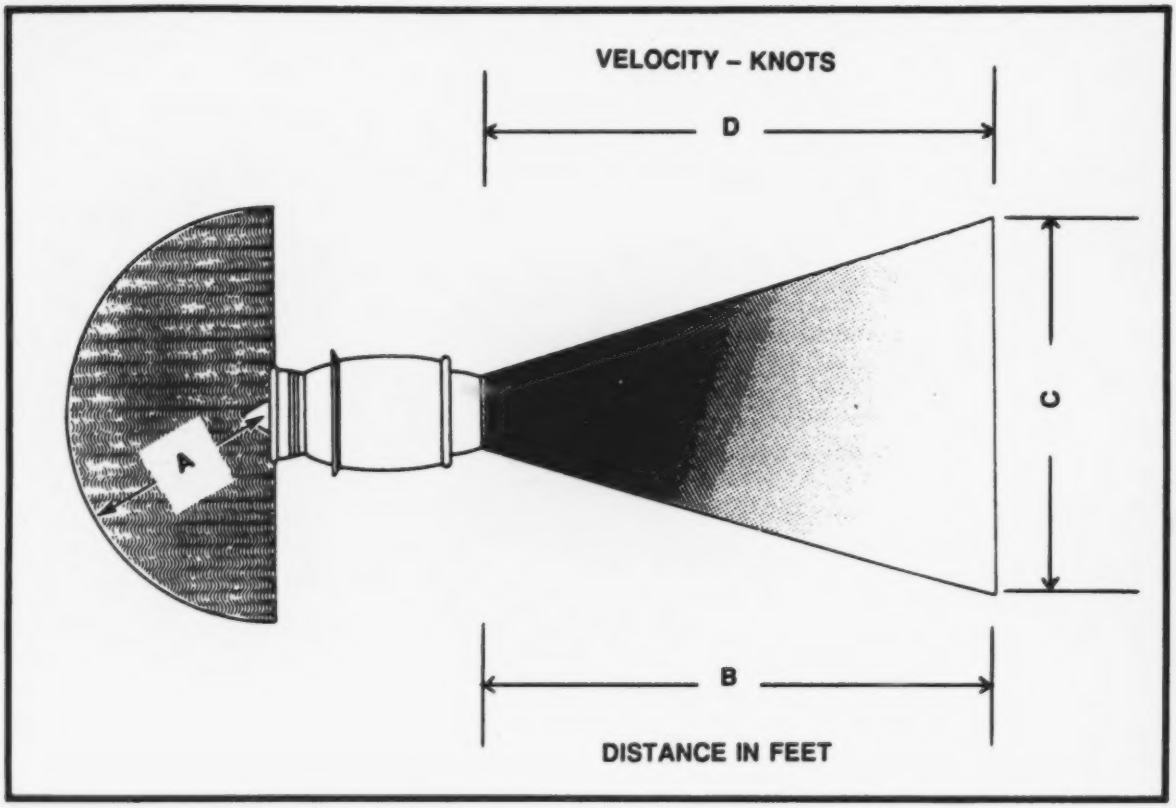



FIGURE 5.—Inlet and Exhaust Jet Wake Danger Areas for a Typical Turbofan Engine.

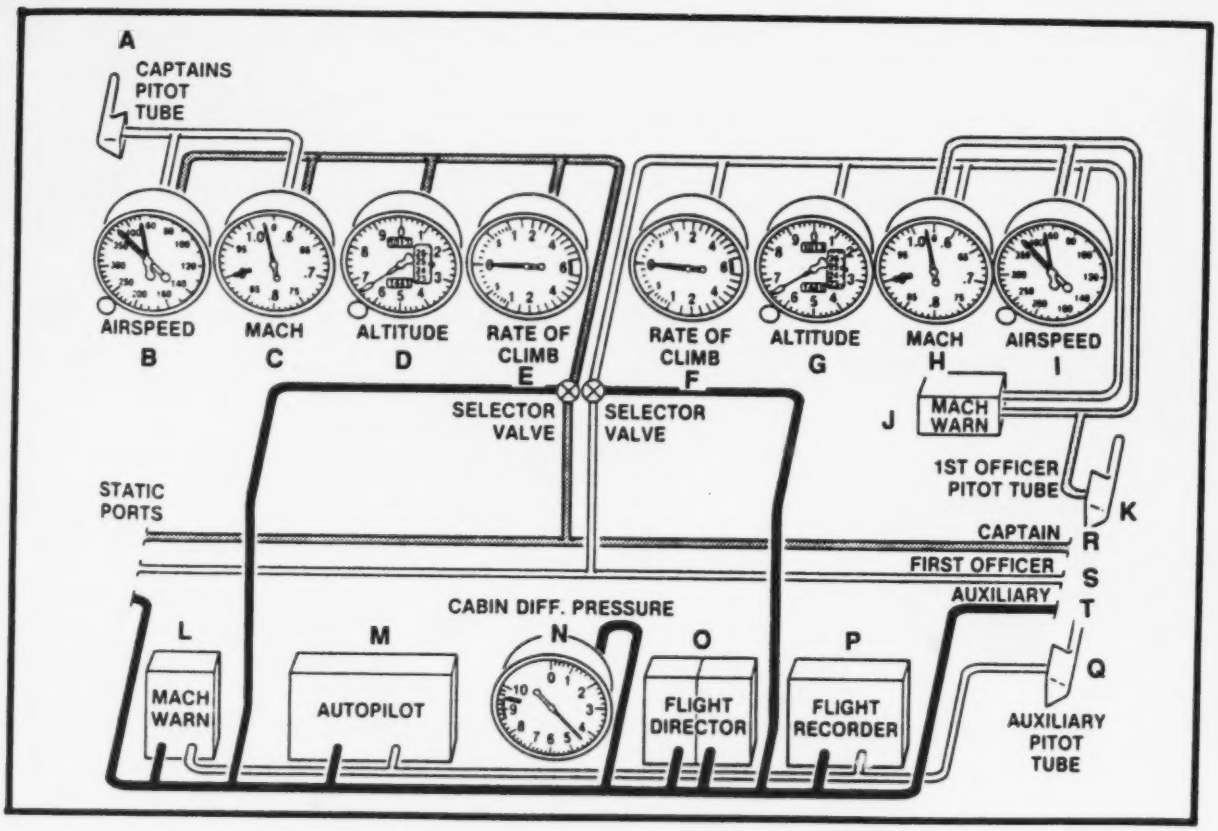



FIGURE 6.—Pitot-Static System for a Typical Large Jet Transport Airplane.

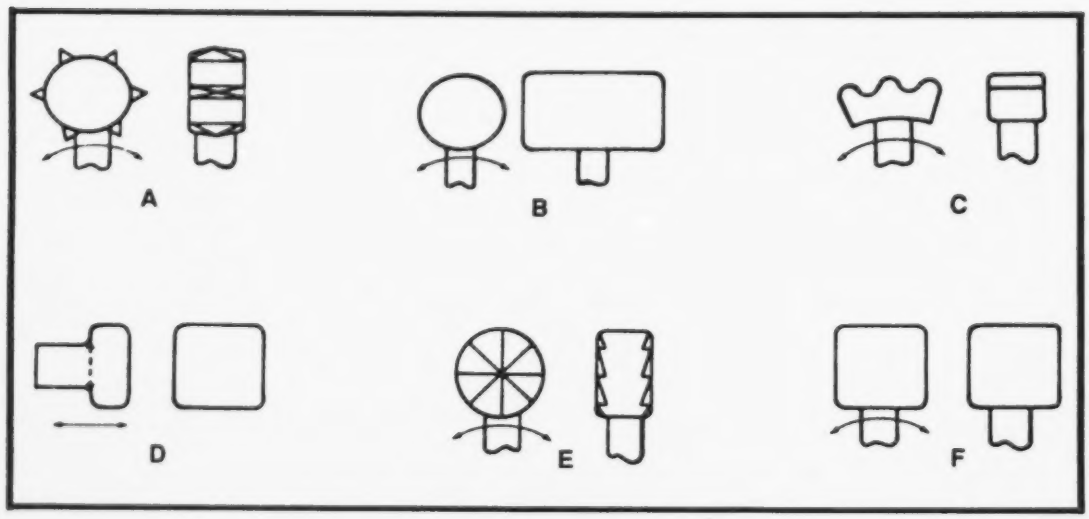



FIGURE 7.—Quadrant Design.

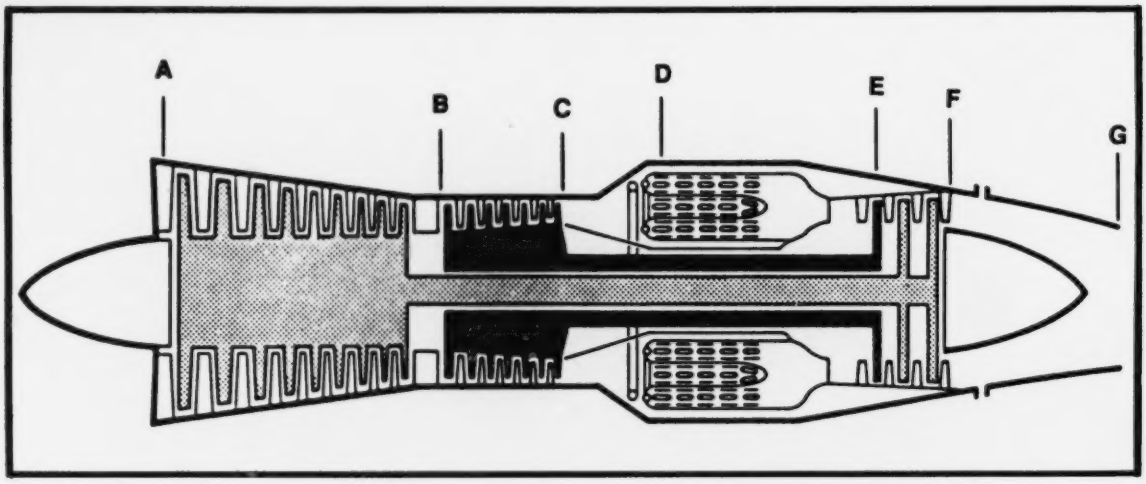



FIGURE 8.—Temperatures in a Two-Spool Turbojet Aircraft Engine.

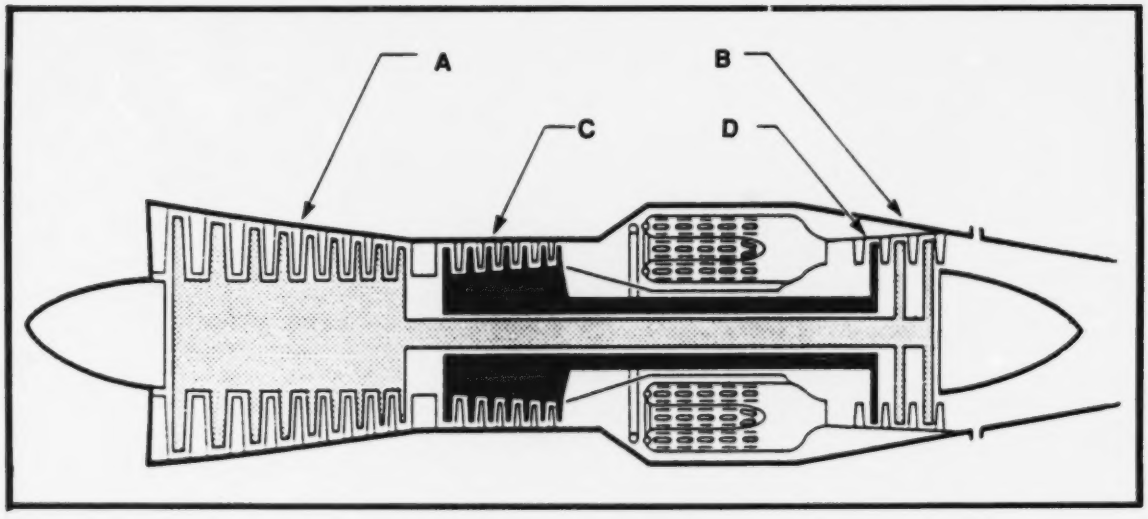



FIGURE 9.—Dual-Spool Axial-Flow Compressor.

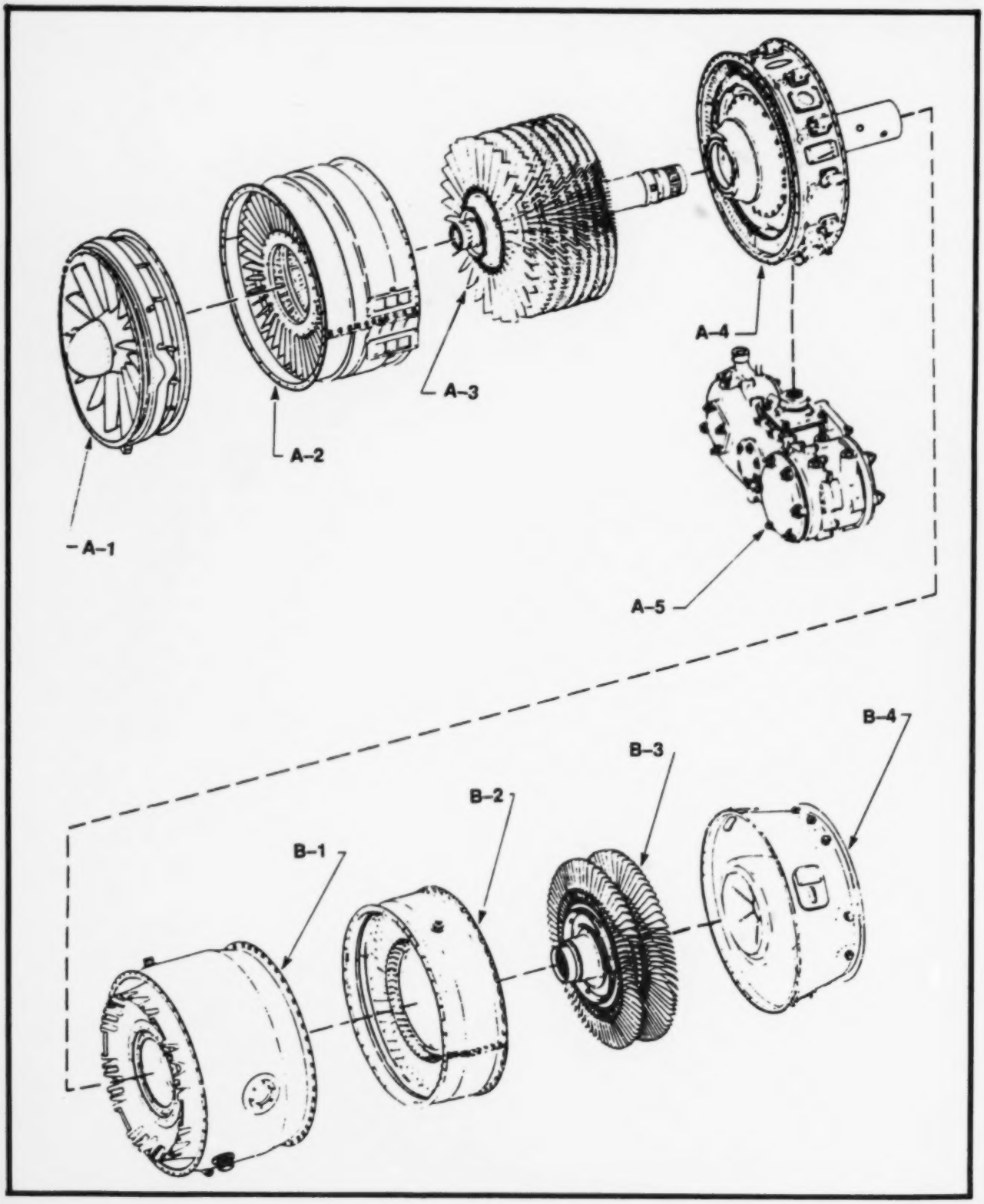
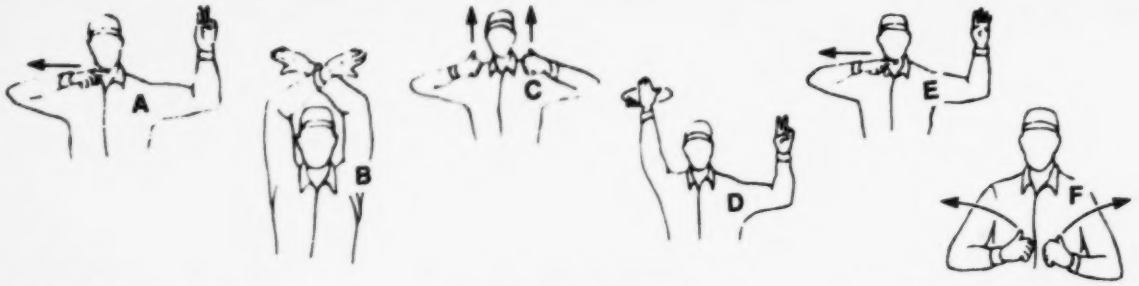



FIGURE 10.—Major Subassemblies of an Axial-Flow Gas Turbine Engine.




(A) Draw right forefinger across throat. When necessary for multi-engine aircraft, use a numerical finger signal (or point) with the left hand to designate engine.
(B) As soon as the signal is observed, cross both arms high above the face. The sequence of signals may be reversed, if more expedient.

(C) With the fingers of both hands curled and both thumbs extended up, make a gesture pointing upward.
(D) As soon as the signal is observed, use circular motion with right hand and arm extended over the head (as for an engine start). When necessary for multi-engine aircraft, use a numerical finger signal (or point) with the left hand to designate engine.

(E) Draw right forefinger across throat. When necessary for multi-engine aircraft, use a numerical finger signal (or point) with the left hand to designate engine.
(F) As soon as the signal is observed, extend both thumbs upward, then out. Repeat, if necessary.

**AFFIRMATIVE CONDITION**
**SATISFACTORY, OK, TRIM GOOD, ETC.**
Hold up thumb and forefinger touching at the tips to form the letter "O".

**NEGATIVE CONDITION**
**UNSATISFACTORY**
**NO GOOD, ETC.**
With the fingers curled and thumb extended, point the thumb downward toward the ground.

**ADJUST UP**
**(higher)**
With the fingers extended and palm facing up, move hand up (and down), vertically, as if coaxing upward.

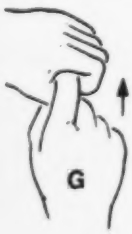
**ADJUST DOWN**
**(lower)**
With the fingers extended and palm facing down, move hand down (and up), vertically, as if coaxing downward.

**SLIGHT ADJUSTMENT**
Hold up thumb and forefinger, slightly apart (either simultaneously) with the other hand when calling for an up or down adjustment, or with the same hand, immediately following the adjustment signal.

**SHORTEN ADJUSTMENT**
**(as when adjusting linkage)**
Hold up thumb and forefinger somewhat apart (other fingers curled), then bring thumb and forefinger together in a slow, closing motion.

**LENGTHEN ADJUSTMENT**
**(as when adjusting linkage)**
Hold up thumb and forefinger pressed together (other fingers curled), then separate thumb and forefinger in a slow, opening motion.

**NUMERICAL READING**
**(of any instrument or to report a numerical value of any type)**
Hold up appropriate number of fingers of either one or both hands, as necessary, in numerical sequence, i.e., 5, then 7 = 57.




Insert extended forefinger of right hand into cupped fist of left hand.

Withdraw extended forefinger of right hand from cupped fist of left hand.

Circular motion with right hand and arm extended over the head. When necessary for multi-engine aircraft, use a numerical finger signal (or point) with the left hand to designate which engine.

*NOTE: To use an "ALL CLEAR TO START" signal, pilot or engine operator initiates the signal from the aircraft cockpit. Ground crewman repeats the signal to indicate "ALL CLEAR TO START ENGINE."

FIGURE 11.—Common Hand Signals for Use with Turbojet Aircraft.

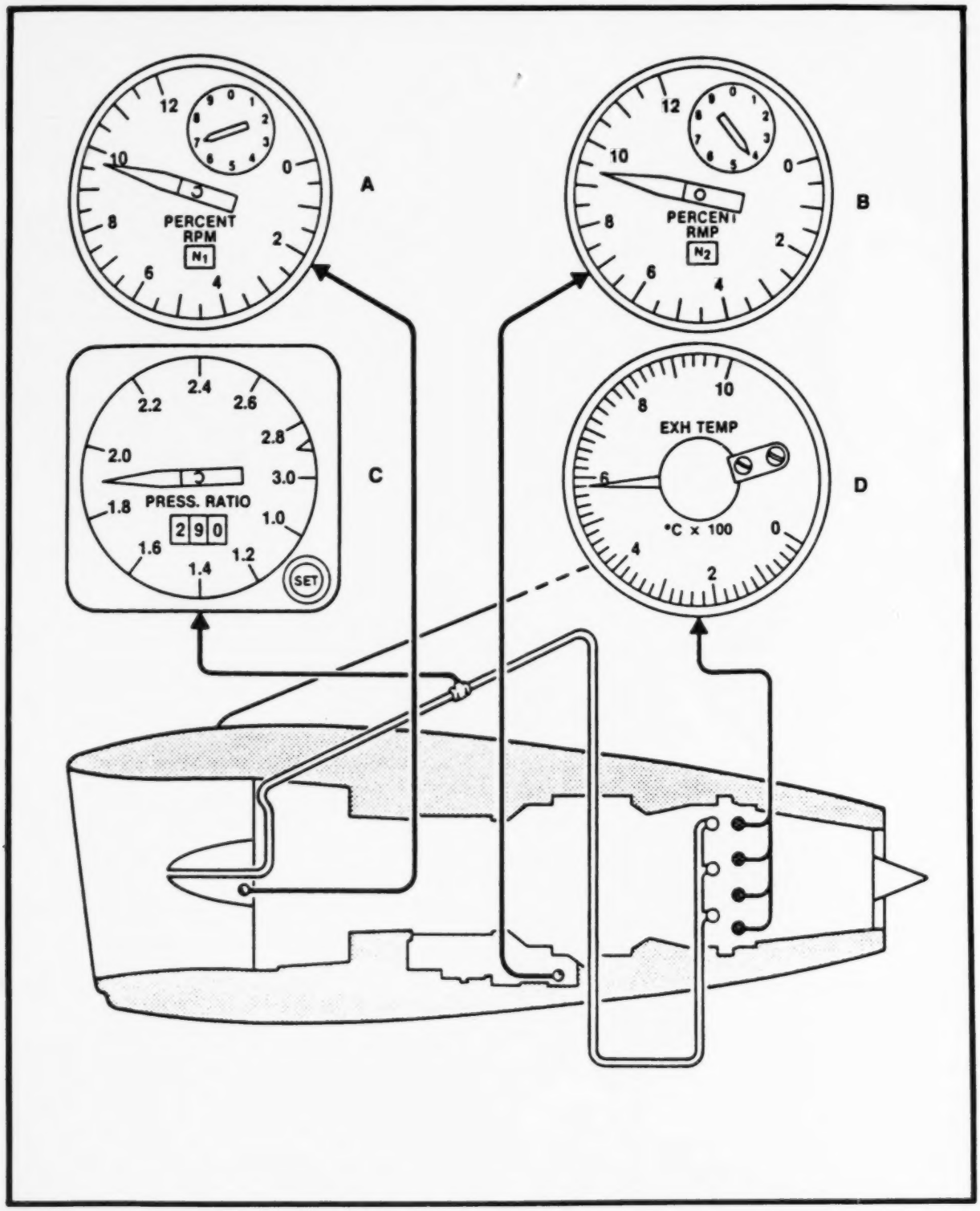



FIGURE 12.—Basic Powerplant Instruments of a Two-Stage Axial-Flow Turbine Engine.

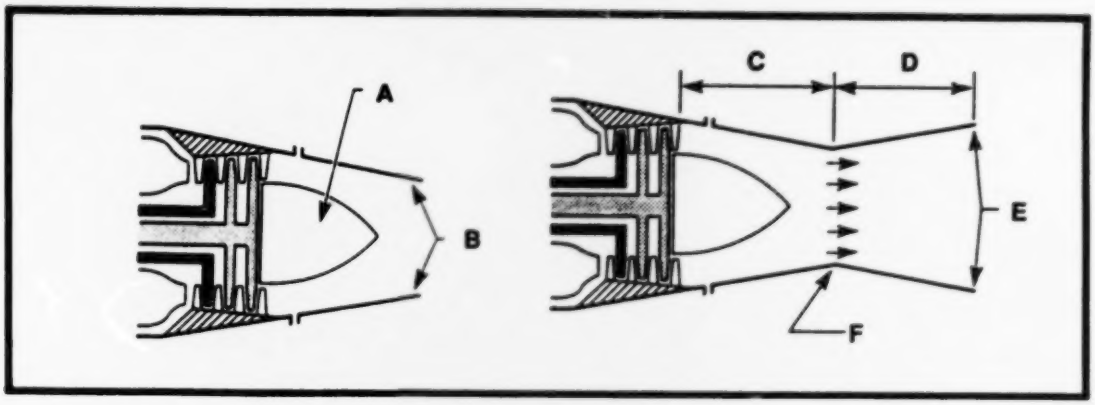



FIGURE 13.—Exhaust Nozzles.

| To Convert From | To | Multiply By |
|---|---|---|
| acres | sq ft | $4.356 \times 10^4$ |
| atmospheres | cm Hg at 0°C | 76.00 |
| | in. Hg at 0°C | 29.92 |
| | lb/sq in | 14.696 |
| | bars | 1.013 |
| bars | lb/sq in | 14.5 |
| Btu | ft-lb | 778.26 |
| | kilowatt-hr | $2.931 \times 10^{-4}$ |
| | joules | 1055 |
| Btu/sec | watts | 1055 |
| centimeters | in | 0.3937 |
| cm Hg | in. $H_2O$ at 4°C | 5.354 |
| | lb/sq in | $1.934 \times 10^{-1}$ |
| cm/second | Ft/sec | $3.281 \times 10^{-2}$ |
| circular mils | sq in | $7.854 \times 10^{-7}$ |
| cu centimeters | cu in | $6.102 \times 10^{-2}$ |
| | U.S. gal | $2.642 \times 10^{-4}$ |
| cu ft | cu cm | $2.832 \times 10^4$ |
| | U.S. gal | 7.481 |
| | liters | 28.32 |
| cu ft $H_2O$ | lb | 62.428 |
| cu in. | cu cm | 16.39 |
| | liters | $1.639 \times 10^{-2}$ |
| | U.S. gal | $4.329 \times 10^{-3}$ |
| cu meters | U.S. gal | 264.2 |
| deg [arc] | radians | $1.745 \times 10^{-2}$ |
| feet | meters | $3.048 \times 10^{-1}$ |
| ft/min | mph | $1.136 \times 10^{-2}$ |
| | km/hr | $1.829 \times 10^{-2}$ |
| ft/sec | mph | .6818 |
| | cm/sec | 30.48 |
| | knots | .5925 |
| ft-lb/min | hp | $3.030 \times 10^{-5}$ |
| ft-lb/sec | hp | $1.818 \times 10^{-3}$ |
| | kilowatts | $1.356 \times 10^{-3}$ |
| fluid oz | dram | 8 |
| gal, Imperial | cu in. | 277.4 |
| | U.S. gal | 1.201 |
| | liters | 4.546 |
| gal, U.S. dry | U.S. gal, liquid | 1.164 |
| gal, U.S. liquid | cu in. | 231.0 |
| grams | oz avdp | $3.527 \times 10^{-2}$ |
| | lb avdp | $2.205 \times 10^{-3}$ |
| grams/cm | lb/ft | $6.721 \times 10^{-2}$ |
| hectopieze | in. Hg | 29.53 |
| horsepower | ft-lb/min | 33,000 |
| | ft-lb/sec | 550 |
| | m-kg/sec | 76.04 |
| | kilowatts | $7.457 \times 10^{-1}$ |
| | Btu/sec | $7.068 \times 10^{-1}$ |
| horsepower, metric | hp | $9.863 \times 10^{-1}$ |
| in. | cm | 2.540 |
| in. water at 4°C | in. Hg at 0°C | $7.355 \times 10^{-2}$ |
| kilograms | lb | 2.205 |
| | oz | 35.27 |
| kilometers | ft | $3.281 \times 10^3$ |
| | miles | $6.214 \times 10^{-1}$ |
| | nautical miles | $5.400 \times 10^{-1}$ |
| km/hr | ft/sec | $9.113 \times 10^{-1}$ |
| | knots | $5.396 \times 10^{-1}$ |
| | mph | $6.214 \times 10^{-1}$ |
| kilowatts | Btu/sec | $9.480 \times 10^{-1}$ |
| | hp | 1.341 |

FIGURE 14.—Conversion Factors.

## Appendix 2

| To Convert From | To | Multiply By |
|---|---|---|
| knots | nautical mph | 1.0 |
| | ft/sec | 1.688 |
| | mph | 1.151 |
| liters | cu cm | $10^3$ |
| | cu in. | 61.03 |
| | U.S. gal | $2.642 \times 10^{-1}$ |
| meters | in. | 39.37 |
| | ft | 3.281 |
| meter-kilogram | ft-lb | 7.233 |
| meter/sec | ft/sec | 3.281 |
| microns | in. | $3.937 \times 10^{-5}$ |
| miles [stat.] | ft | 5280 |
| | km | 1.609 |
| mph | ft/sec | 1.467 |
| | km/hr | 1.609 |
| | knots | $8.690 \times 10^{-1}$ |
| milibars | in. Hg at 0°C | $2.953 \times 10^{-2}$ |
| nautical miles [naumiles] | ft | 6076.1 |
| | miles [stat.] | 1.151 |
| | m | 1852 |
| ounces, avdp | grams | 28.35 |
| ounces, fluid | cu in. | 1.805 |
| lb/avdp | grams | 453.6 |
| | ounces | 16.0 |
| lb/cu in. | grams/cu cm | 27.68 |
| lb/sq in. | in. Hg at 0°C | 2.036 |
| radians | deg [arc] | 57.30 |
| radians/sec | deg/sec | 57.30 |
| | rev/min | 9.549 |
| revolutions | radians | 6.283 [$2\pi$] |
| rev/min | radians/sec | $1.047 \times 10^{-1}$ |
| slug | lb | 32.174 |
| sq cm | sq in. | $1.550 \times 10^{-1}$ |
| sq ft | sq cm | 929.0 |
| sq in. | sq cm | 6.452 |
| sq meters | sq ft | 10.76 |
| sq miles | sq km | 2.590 |
| watts | Btu/sec | $9.481 \times 10^{-4}$ |

FIGURE 14A.—Conversion Factors.

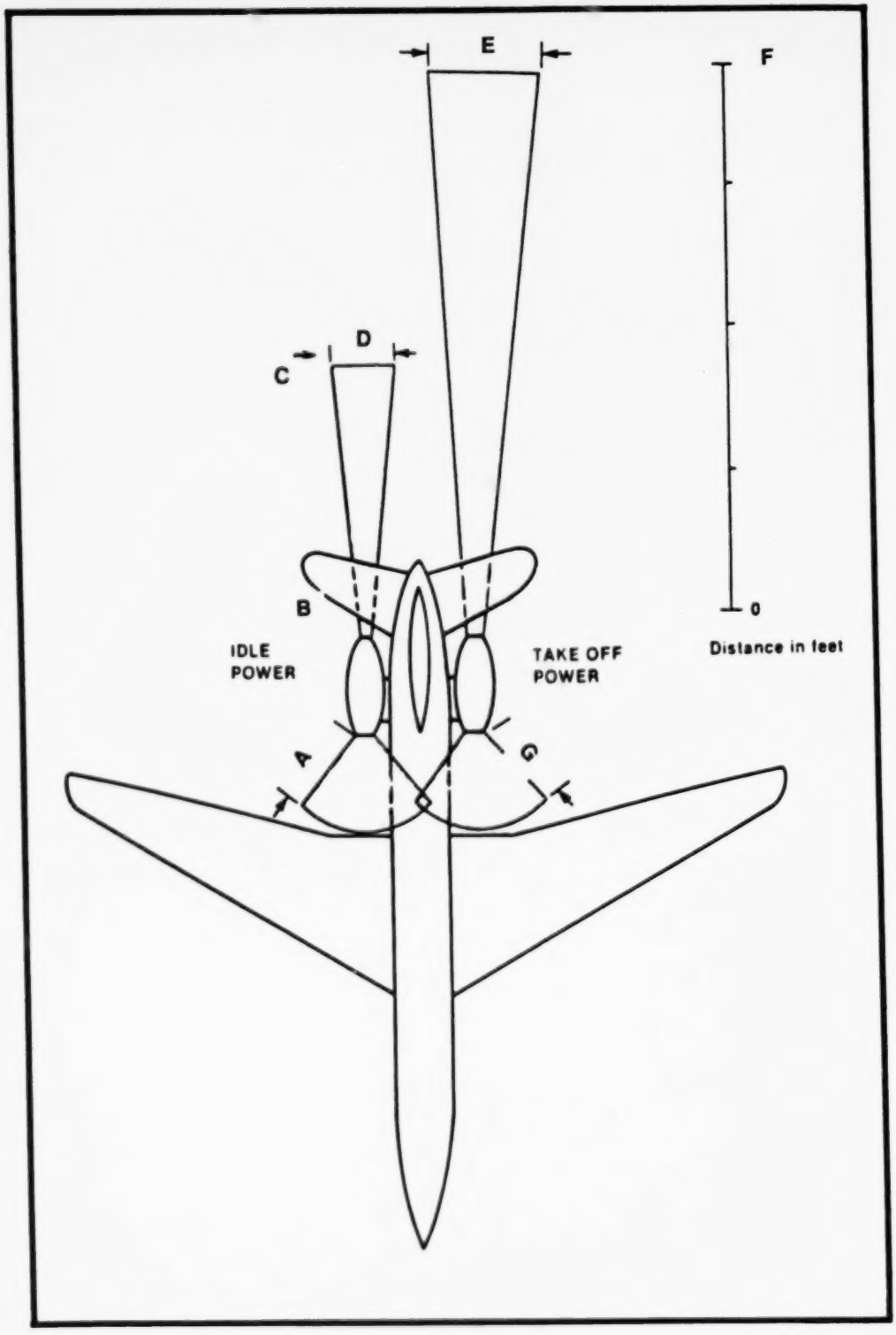



FIGURE 15.—Danger Areas Around a Jet Aircraft.

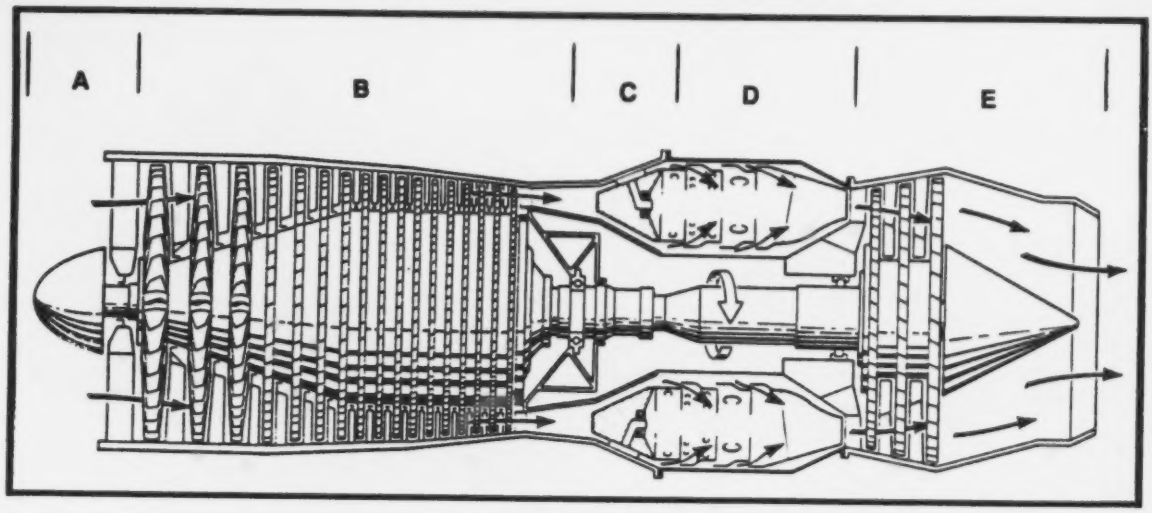



FIGURE 16.—Airflow Path.

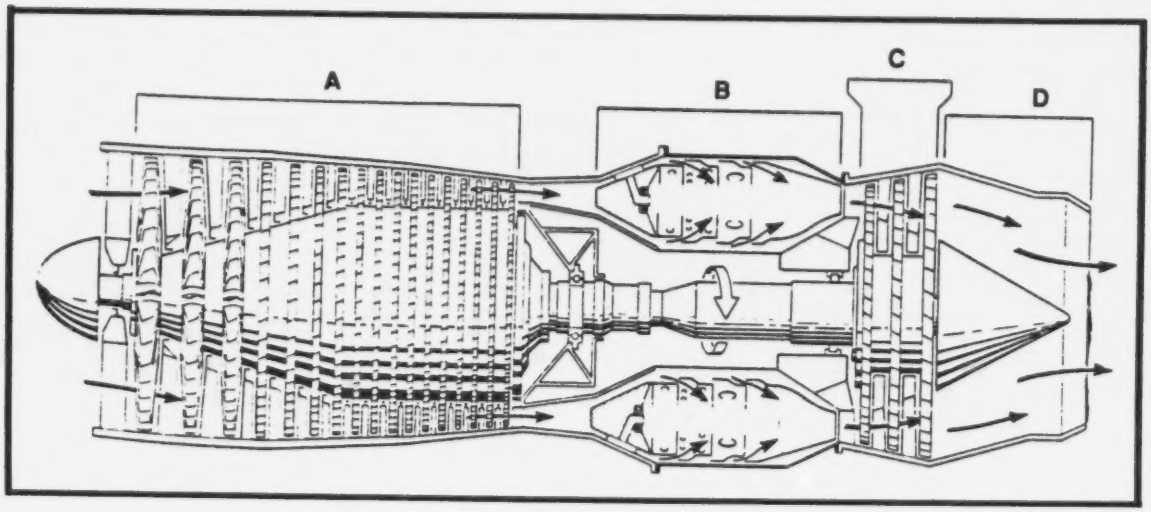



FIGURE 17.—Airflow Path.

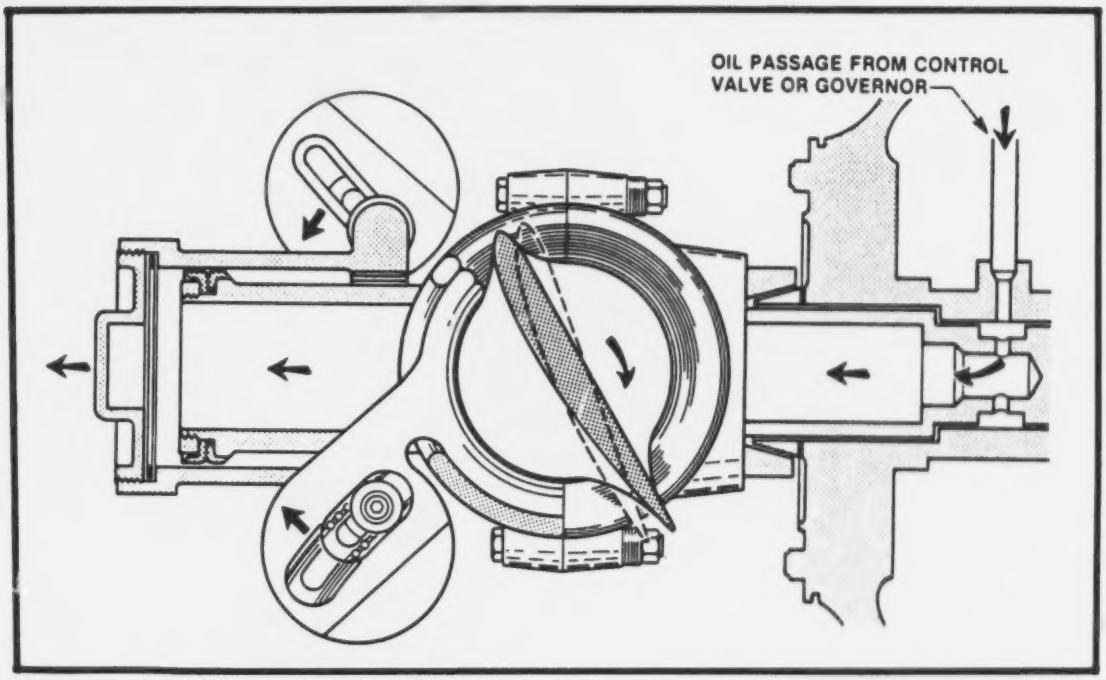



FIGURE 18.—Engine Oil Entering the Cylinder of a Counterweight Propeller.

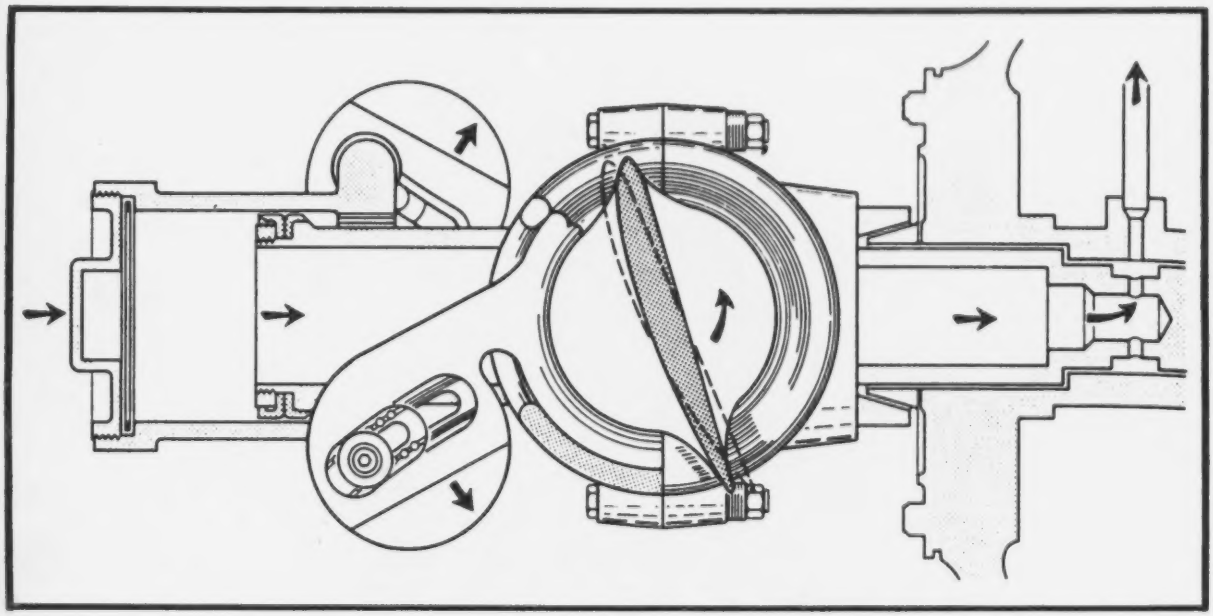


FIGURE 19.—Oil Draining from the Cylinder of a Counterweight Propeller.

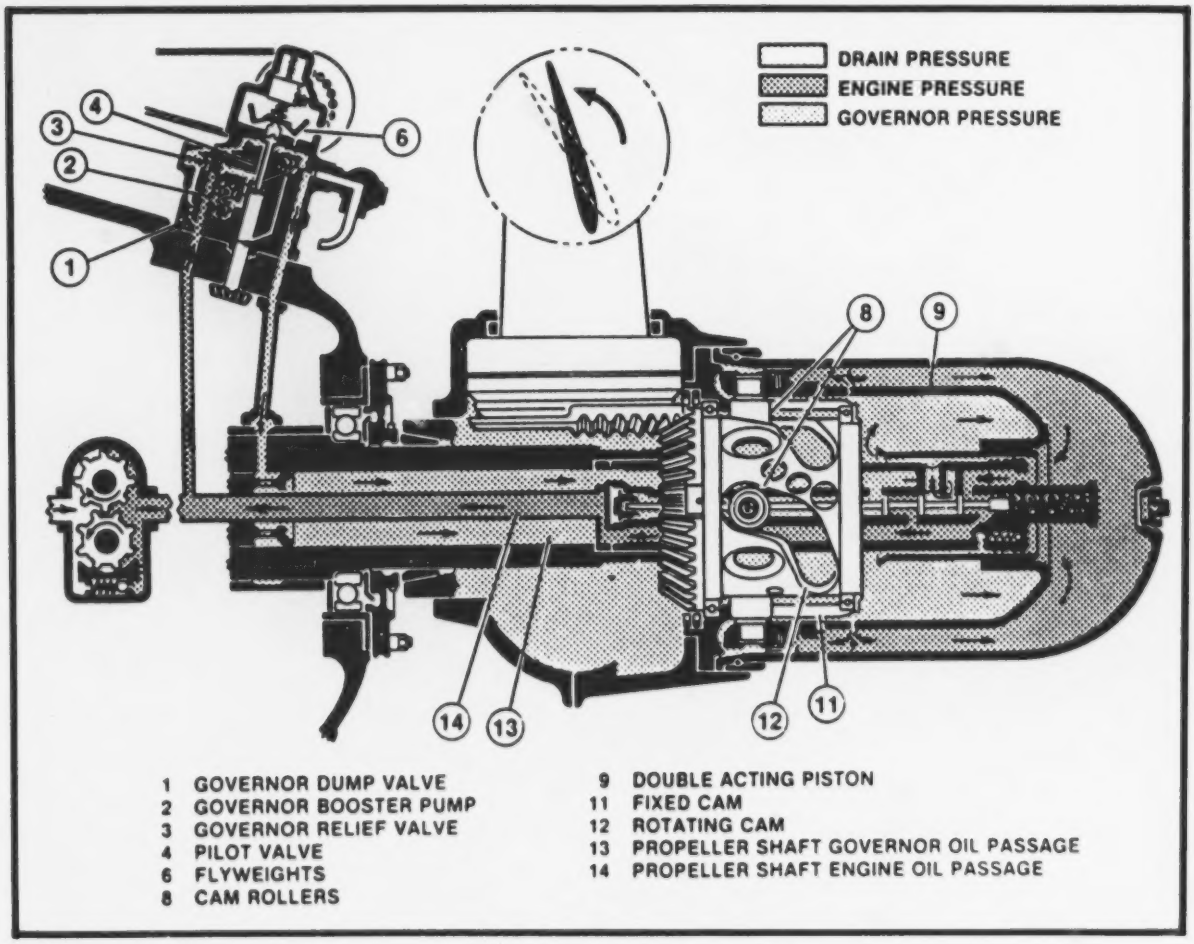



FIGURE 20.—Hydromatic Propeller Installation.

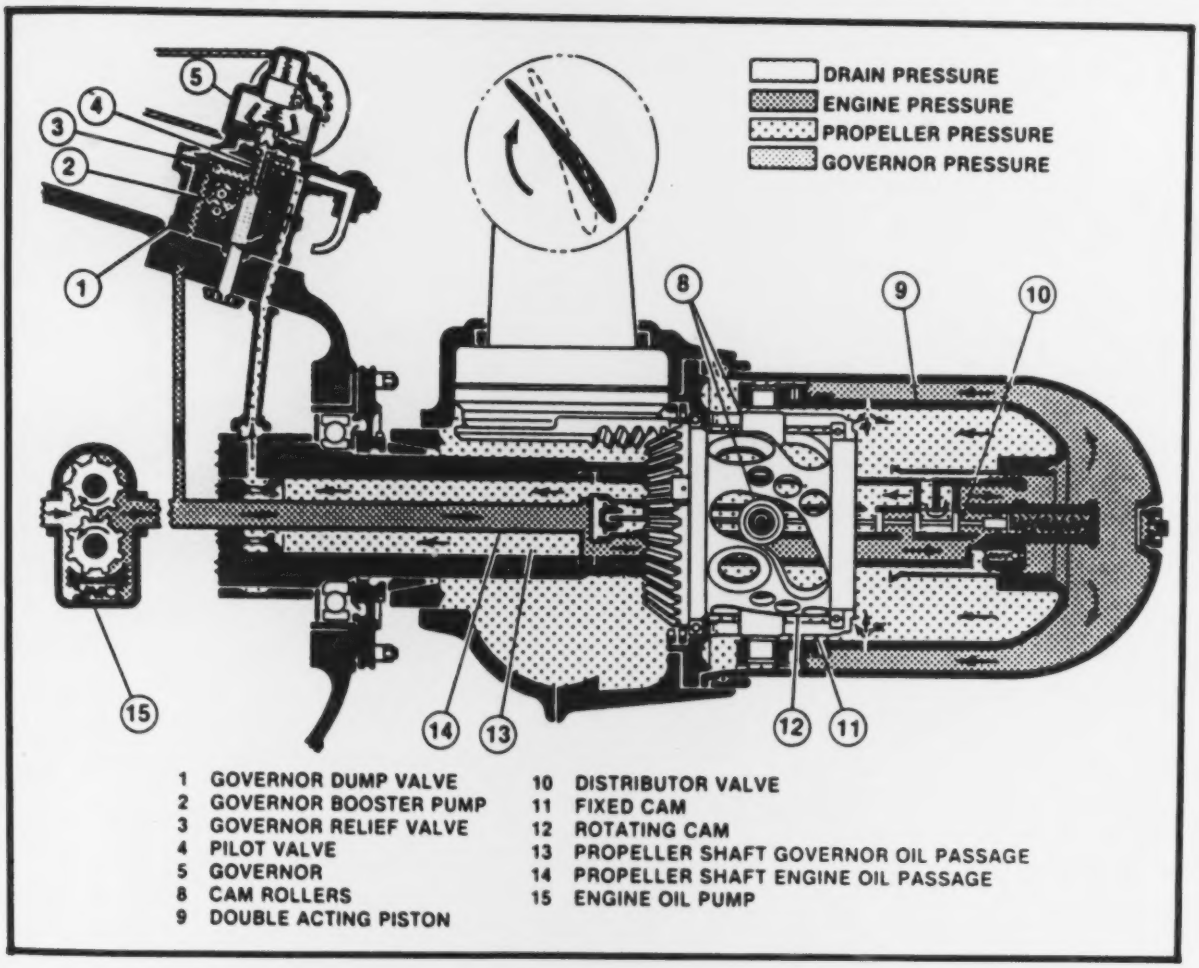



FIGURE 21.—Hydromatic Propeller Installation.

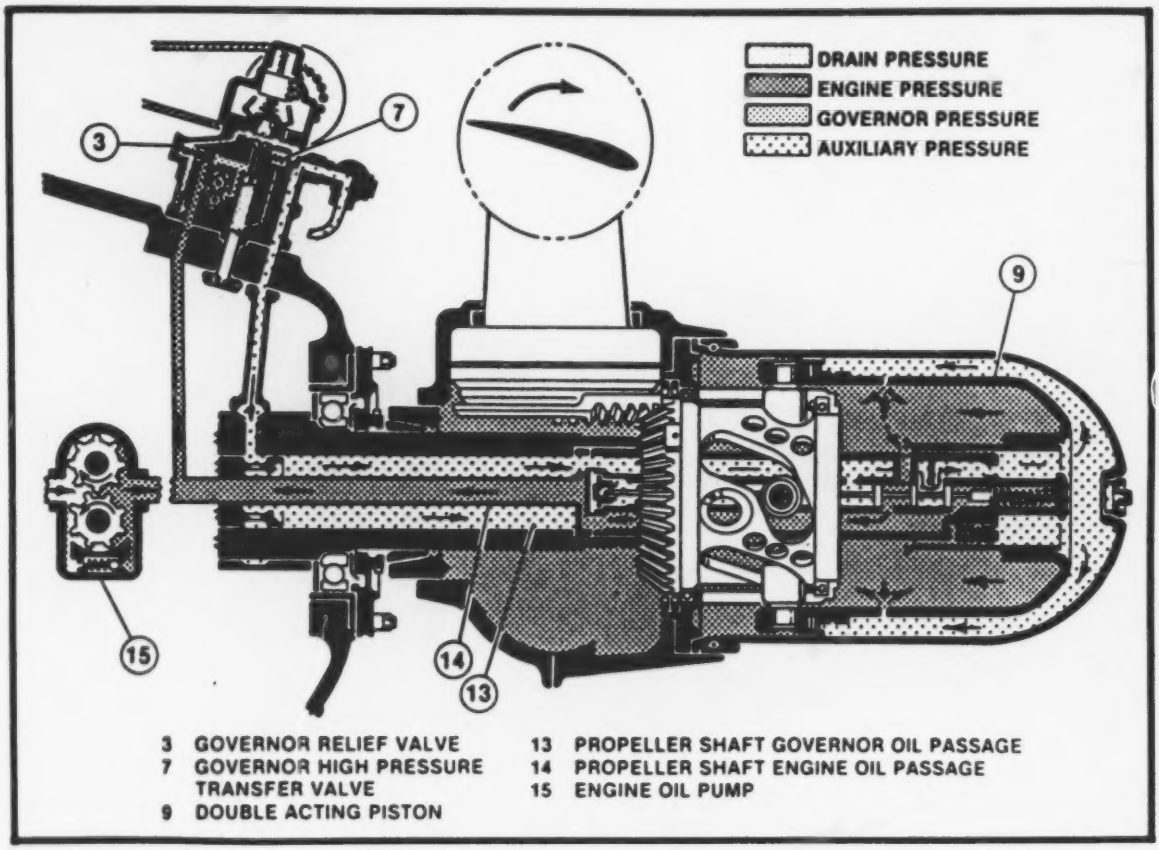



FIGURE 22.—Hydromatic Propeller Installation.

# Power Schedule
## P&W R-2800 CB-16 Wet Takeoff
## BMEP at Various Conditions of Temperature & Humidity
## 2800 RPM, Sea Level, ADI ON

| Manifold Pressure * | Dew Point Temperature °C | Dew Point Temperature °F | Carburetor Air Temperature 10°C 50°F | 15°C 59°F | 20°C 68°F | 25°C 77°F | 30°C 86°F | 35°C 95°F | 40°C 104°F |
|---|---|---|---|---|---|---|---|---|---|
| 59.6 | -4 | 25 | 244 | 242 | 240 | 238 | 235 | 233 | 231 |
| 59.7 | -1 | 30 | 244 | 242 | 239 | 238 | 235 | 233 | 231 |
| 59.7 | 1 | 35 | 243 | 241 | 239 | 237 | 234 | 232 | 230 |
| 59.7 | 4 | 40 | 242 | 240 | 238 | 236 | 234 | 232 | 230 |
| 59.8 | 7 | 45 | 242 | 240 | 238 | 236 | 233 | 231 | 229 |
| 59.8 | 10 | 50 | 241 | 239 | 237 | 235 | 233 | 231 | 228 |
| 59.9 | 13 | 55 | | 238 | 236 | 234 | 232 | 230 | 228 |
| 60.0 | 16 | 60 | | 238 | 235 | 234 | 231 | 229 | 227 |
| 60.1 | 18 | 65 | | | 234 | 233 | 230 | 228 | 226 |
| 60.2 | 21 | 70 | | | 233 | 232 | 229 | 227 | 225 |
| 60.4 | 24 | 75 | | | | 230 | 228 | 226 | 224 |
| 60.5 | 27 | 80 | | | | 228 | 226 | 224 | 222 |
| 60.7 | 29 | 85 | | | | | 224 | 222 | 220 |
| 60.9 | 32 | 90 | | | | | | 220 | 218 |

* 59.5" OF MANIFOLD PRESSURE PLUS EXISTING VAPOR PRESSURE, UP TO 1.5".

SPECIAL NOTE - FOR CB-16 DRY TAKEOFF POWER SCHEDULE APPLY THE FOLLOWING:

RPM=2700

SUBTRACT APPROXIMATELY 30 BMEP FROM THE ABOVE SETTINGS.

SUBTRACT APPROXIMATELY 5 INCHES OF MANIFOLD PRESSURE FROM THE ABOVE SETTINGS.

FIGURE 23.—Power Schedule.

| OPERATING CONDITIONS | 1 | 2 | 3 |
|---|---|---|---|
| CAT | 86° F | 95° F | 20° C |
| DEWPOINT | 40° F | 90° F | 13° C |
| ADI | ON | ON | OFF |

FIGURE 24.—Operating Conditions.

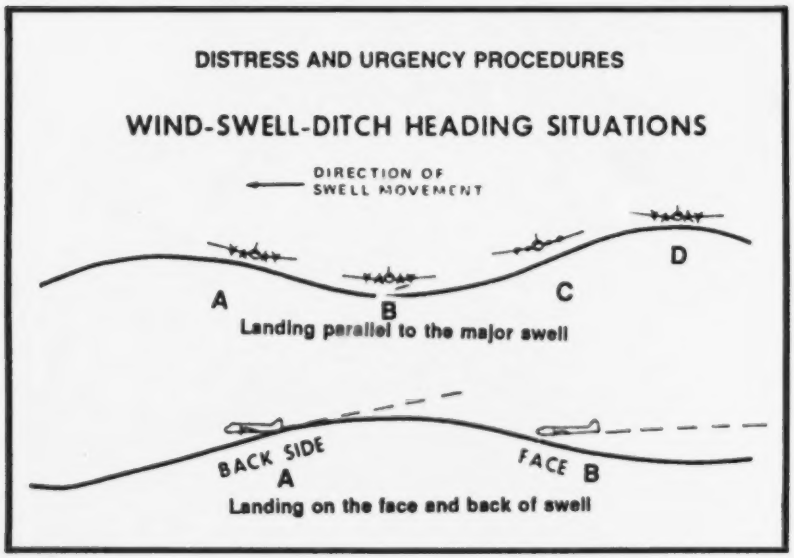



FIGURE 25.—Ditching.

## PASSENGER LOADING TABLE

| Number of Pass. | Weight Lbs. | Moment / 1000 |
|---|---|---|
| FORWARD COMPARTMENT CENTROID—582.0 | | |
| 5 | 850 | 495 |
| 10 | 1,700 | 989 |
| 15 | 2,550 | 1,484 |
| 20 | 3,400 | 1,979 |
| 25 | 4,250 | 2,473 |
| 29 | 4,930 | 2,869 |
| AFT COMPARTMENT CENTROID—1028.0 | | |
| 10 | 1,700 | 1,748 |
| 20 | 3,400 | 3,495 |
| 30 | 5,100 | 5,243 |
| 40 | 6,800 | 6,990 |
| 50 | 8,500 | 8,738 |
| 60 | 10,200 | 10,486 |
| 70 | 11,900 | 12,233 |
| 80 | 13,600 | 13,980 |
| 90 | 15,300 | 15,728 |
| 100 | 17,000 | 17,476 |
| 110 | 18,700 | 19,223 |
| 120 | 20,400 | 20,971 |
| 133 | 22,610 | 23,243 |

## CARGO LOADING TABLE

| | Moment / 1000 | |
|---|---|---|
| Weight Lbs. | Forward Hold Arm 680.0 | Aft Hold Arm 1168.0 |
| 6,000 | | 6,966 |
| 5,000 | 3,400 | 5,830 |
| 4,000 | 2,720 | 4,664 |
| 3,000 | 2,040 | 3,498 |
| 2,000 | 1,360 | 2,332 |
| 1,000 | 680 | 1,166 |
| 900 | 612 | 1,049 |
| 800 | 544 | 933 |
| 700 | 476 | 816 |
| 600 | 408 | 700 |
| 500 | 340 | 583 |
| 400 | 272 | 466 |
| 300 | 204 | 350 |
| 200 | 136 | 233 |
| 100 | 68 | 117 |

NOTE: THESE COMPUTATIONS ARE TO BE USED FOR TESTING PURPOSES ONLY.

## FUEL LOADING TABLE

| TANKS 1 & 3 (EACH) | | | TANK 2 (3 CELL) | | | | | |
|---|---|---|---|---|---|---|---|---|
| Weight Lbs. | Arm | Moment / 1000 | Weight Lbs. | Arm | Moment / 1000 | Weight Lbs. | Arm | Moment / 1000 |
| 8,500 | 992.1 | 8,433 | 8,500 | 917.5 | 7,799 | 22,500 | 914.5 | 20,576 |
| 9,000 | 993.0 | 8,937 | 9,000 | 917.2 | 8,255 | 23,000 | 914.5 | 21,034 |
| 9,500 | 993.9 | 9,442 | 9,500 | 917.0 | 8,711 | 23,500 | 914.4 | 21,488 |
| 10,000 | 994.7 | 9,947 | 10,000 | 916.8 | 9,168 | 24,000 | 914.3 | 21,943 |
| 10,500 | 995.4 | 10,451 | 10,500 | 916.6 | 9,624 | 24,500 | 914.3 | 22,400 |
| 11,000 | 996.1 | 10,957 | 11,000 | 916.5 | 10,082 | 25,000 | 914.2 | 22,855 |
| 11,500 | 996.8 | 11,463 | 11,500 | 916.3 | 10,537 | 25,500 | 914.2 | 23,312 |
| 12,000 | 997.5 | 11,970 | 12,000 | 916.1 | 10,993 | 26,000 | 914.1 | 23,767 |
| FULL CAPACITY | | | **(See note at lower left) | | | 26,500 | 914.1 | 24,244 |
| **Note: Computations for Tank 2 weights for 12,500 lbs. to 18,000 lbs. have been purposely omitted. | | | 18,500 | 915.1 | 16,929 | 27,000 | 914.0 | 24,678 |
| | | | 19,000 | 915.0 | 17,385 | 27,500 | 913.9 | 25,132 |
| | | | 19,500 | 914.9 | 17,841 | 28,000 | 913.9 | 25,589 |
| | | | 20,000 | 914.9 | 18,298 | 28,500 | 913.8 | 26,043 |
| | | | 20,500 | 914.8 | 18,753 | 29,000 | 913.7 | 26,497 |
| | | | 21,000 | 914.7 | 19,209 | 29,500 | 913.7 | 26,954 |
| | | | 21,500 | 914.6 | 19,664 | 30,000 | 913.6 | 27,408 |
| | | | 22,000 | 914.6 | 20,121 | FULL CAPACITY | | |

FIGURE 26.—Loading Tables.

The table below gives the approximate duration of the cabin oxygen system, based on a cylinder pressure of 1500 psi.

| CABIN ALTITUDE | NUMBER OF PASSENGERS | *APPROX. DURATION |
|---|---|---|
| 15,000 | 50 | 62 mins. |
| | 75 | 40 mins. |
| | 100 | 28 mins. |
| | 135 | 23 mins. |
| 20,000 | 50 | 41 mins. |
| | 75 | 26 mins. |
| | 100 | 19 mins. |
| | 135 | 16 mins. |
| 25,000 | 50 | 27 mins. |
| | 75 | 17 mins. |
| | 100 | 12 mins. |
| | 135 | 10 mins. |

For cylinder pressures less than 1500 psi, reduce duration by 8% for each 100 psi.

FIGURE 27.—Cabin Oxygen Duration.

INFLIGHT ENGINE START ENVELOPE

| IAS KNOTS | | PRESSURE ALTITUDE 1000 FT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| $V_{MO}/M_{MO}$ | $N_1$% | 18 | 20 | 22 | 23 | 25 | 26 | 26 | 26 | 27 |
| | $N_2$% | 27 | 29 | 32 | 34 | 37 | 37 | 35 | 34 | 33 |
| 400 | | | | | 23 | 25 | | | | |
| | | | | | 34 | 36 | | | | |
| 380 | | 18 | 19 | 21 | 22 | 24 | 26 | | | |
| | | 27 | 28 | 30 | 32 | 34 | 37 | | | |
| 360 | | 17 | 18 | 20 | 21 | 23 | 25 | | | |
| | | 25 | 27 | 28 | 30 | 32 | 34 | | | |
| 340 | | 16 | 17 | 19 | 20 | 21 | 24 | 26 | | |
| | | 24 | 25 | 27 | 28 | 30 | 33 | 35 | | |
| 320 | | 15 | 16 | 18 | 19 | 20 | 22 | 25 | | |
| | | 22 | 23 | 25 | 27 | 28 | 31 | 33 | | |
| 300 | | 14 | 16 | 17 | 18 | 19 | 21 | 23 | 26 | |
| | | 21 | 22 | 23 | 25 | 27 | 29 | 31 | 33 | |
| 280 | | 13 | 15 | 16 | 17 | 18 | 20 | 22 | 24 | |
| | | 19 | 20 | 22 | 23 | 25 | 27 | 29 | 31 | |
| 260 | | 13 | 14 | 15 | 16 | 17 | 18 | 20 | 22 | 26 |
| | | 18 | 19 | 20 | 21 | 23 | 25 | 26 | 29 | 31 |
| 240 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 20 | 23 |
| | | 17 | 17 | 18 | 19 | 21 | 23 | 24 | 26 | 29 |
| 220 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 20 |
| | | 15 | 16 | 17 | 18 | 19 | 21 | 22 | 24 | 26 |

NOMINAL WINDMILLING RPM
TOLERANCE ± 3%

FIGURE 28.—In-Flight Engine Start.

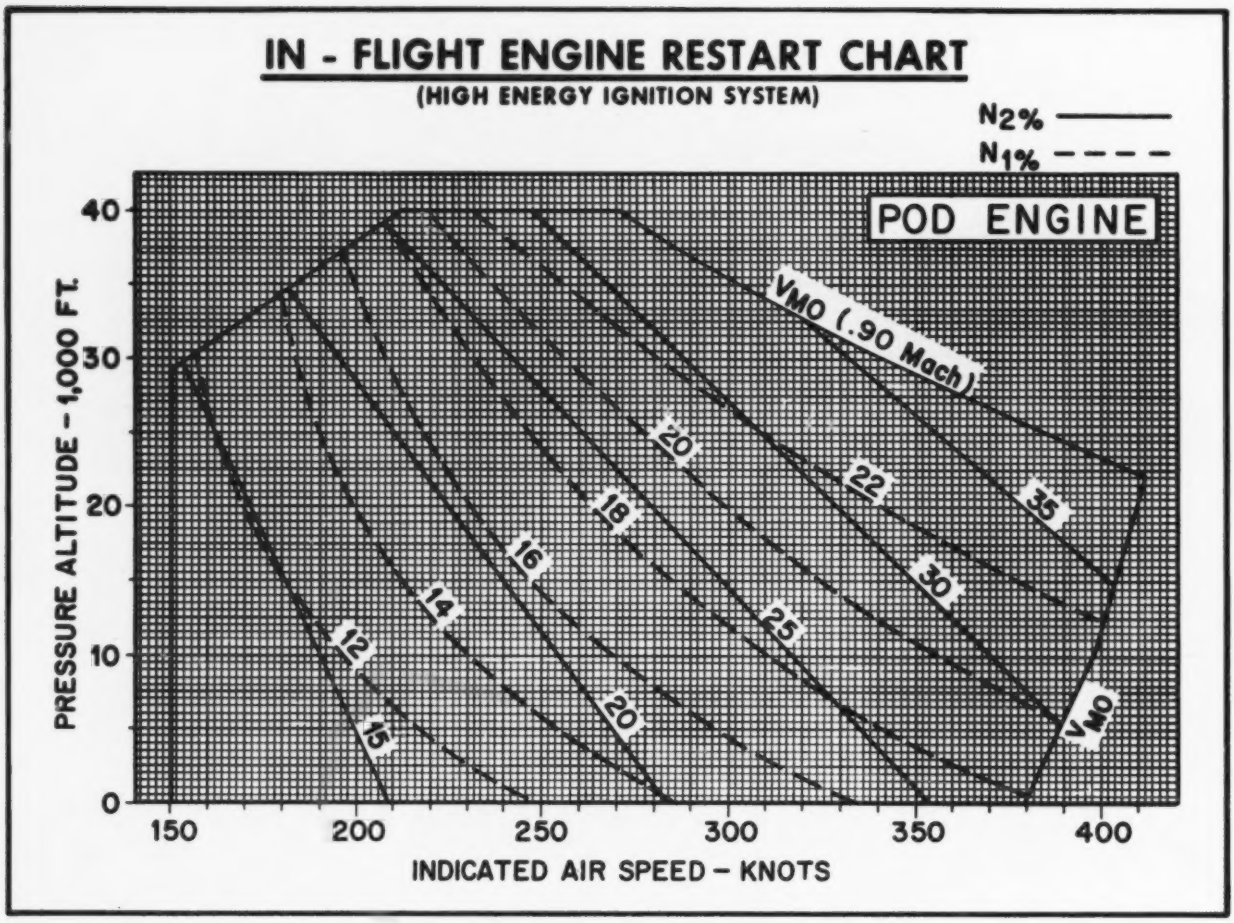



FIGURE 29.—In-Flight Engine Restart.

## GO AROUND EPR

ENG 1 & 3
ENG 2

A/C ON
NO BLEED

| PRESSURE ALTITUDE–FT | OAT | °F | –82 | –10 | 0 | 10 | 18 | 27 | 38 | 47 | 55 | 69 | 73 | 83 | 91 | 100 | 110 | 119 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | °C | –63 | –23 | –18 | –13 | –8 | –3 | 3 | 8 | 13 | 18 | 23 | 28 | 33 | 38 | 43 | 48 |
| | TAT | °C | –60 | –20 | –15 | –10 | –5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| –1000 | ENGINE | 1 & 3 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 1.99 | 1.94 | 1.89 |
| | | 2 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.01 | 1.97 | 1.91 |
| SEA LEVEL | ENGINE | 1 & 3 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.07 | 2.04 | 1.99 | 1.94 | 1.89 |
| | | 2 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.09 | 2.06 | 2.01 | 1.97 | 1.91 |
| 1000 | ENGINE | 1 & 3 | 2.12 | 2.12 | 2.12 | 2.12 | 2.12 | 2.12 | 2.12 | 2.12 | 2.09 | 2.09 | 2.09 | 2.08 | 2.04 | 1.99 | 1.94 | 1.89 |
| | | 2 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.12 | 2.12 | 2.12 | 2.10 | 2.06 | 2.01 | 1.97 | 1.91 |
| 2000 | ENGINE | 1 & 3 | 2.18 | 2.18 | 2.18 | 2.18 | 2.18 | 2.18 | 2.17 | 2.13 | 2.12 | 2.12 | 2.10 | 2.08 | 2.04 | 1.99 | 1.94 | 1.89 |
| | | 2 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.19 | 2.16 | 2.15 | 2.15 | 2.13 | 2.10 | 2.06 | 2.01 | 1.97 | 1.91 |
| 3000 | ENGINE | 1 & 3 | 2.24 | 2.24 | 2.24 | 2.24 | 2.23 | 2.20 | 2.17 | 2.13 | 2.12 | 2.12 | 2.10 | 2.08 | 2.04 | 1.99 | 1.94 | 1.89 |
| | | 2 | 2.27 | 2.27 | 2.27 | 2.27 | 2.25 | 2.22 | 2.19 | 2.16 | 2.15 | 2.15 | 2.13 | 2.10 | 2.06 | 2.01 | 1.97 | 1.91 |
| 3900 AND ABOVE | ENGINE | 1 & 3 | 2.30 | 2.30 | 2.28 | 2.26 | 2.23 | 2.20 | 2.17 | 2.13 | 2.12 | 2.12 | 2.10 | 2.08 | 2.04 | 1.99 | 1.94 | 1.89 |
| | | 2 | 2.32 | 2.32 | 2.30 | 2.28 | 2.25 | 2.22 | 2.19 | 2.16 | 2.15 | 2.15 | 2.13 | 2.10 | 2.06 | 2.01 | 1.97 | 1.91 |

| EPR BLEED CORRECTIONS | | ENG 1&3 | ENG 2 |
|---|---|---|---|
| A/C BLEEDS | | OFF +.04 | ON –.04 |
| ENGINE ANTI-ICE ON | | – – | –.03 |
| ENGINE AND WING ANTI-ICE ON | TWO ENGINE BLEEDS | –.09 | –.03 |
| | ONE ENGINE BLEED | –.10 | –.03 |

FIGURE 30.—Go-Around EPR.

## MAX TAKEOFF $N_1$

| PRESS ALT FT | OAT °F | OAT °C | −65 | −49 | −40 | −31 | −22 | −13 | −4 | 5 | 14 | 23 | 32 | 41 | 50 | 59 | 68 | 77 | 86 | 95 | 104 | 113 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | −54 | −45 | −40 | −35 | −30 | −25 | −20 | −15 | −10 | −5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 49 |
| −1000 S.L. | | | 83.2 | 84.8 | 85.7 | 86.5 | 87.4 | 88.3 | 89.2 | 90.1 | 91.0 | 91.9 | 92.7 | 93.5 | 94.3 | 95.2 | 95.9 | 96.7 | 97.5 | 98.1 | 97.2 | 96.3 | 95.6 |
| | | | 84.7 | 86.3 | 87.2 | 88.1 | 89.1 | 90.0 | 90.9 | 91.8 | 92.7 | 93.6 | 94.4 | 95.3 | 96.1 | 96.9 | 97.8 | 98.5 | 99.0 | 98.1 | 97.2 | 96.3 | 95.6 |
| 1000 2000 | | | 86.4 | 88.0 | 88.9 | 89.9 | 90.8 | 91.7 | 92.7 | 93.6 | 94.5 | 95.4 | 96.3 | 97.1 | 97.4 | 97.8 | 98.6 | 99.2 | 99.0 | 98.1 | 97.2 | 96.3 | 95.6 |
| | | | 88.1 | 89.8 | 90.8 | 91.7 | 92.7 | 93.6 | 94.6 | 95.5 | 96.4 | 97.3 | 97.9 | 97.8 | 97.7 | 98.5 | 99.2 | 99.2 | 99.0 | 98.1 | 97.2 | 96.3 | 95.6 |
| 3000 3856 & ABOVE | | | 89.8 | 91.6 | 92.6 | 93.5 | 94.5 | 95.5 | 96.5 | 97.4 | 98.0 | 98.0 | 97.9 | 97.8 | 97.7 | 98.5 | 99.2 | 99.2 | 99.0 | 98.1 | 97.2 | 96.3 | 95.6 |
| | | | 91.2 | 93.1 | 94.1 | 95.1 | 96.1 | 97.1 | 97.7 | 97.8 | 98.0 | 98.0 | 97.9 | 97.8 | 97.7 | 98.5 | 99.2 | 99.2 | 99.0 | 98.1 | 97.2 | 96.3 | 95.6 |

| $N_1$ BLEED CORRECTIONS | ALL ENGINES OFF + 1.3 |
|---|---|

FIGURE 31.—Maximum Takeoff $N_1$.

## MAX TAKEOFF EPR

0 – 60 KNOTS ENG 1 & 3 AIRBLEED ON ENG 2 NO AIRBLEED

| PRESS ALT FT | ENG | OAT °F | OAT °C | −67 TO − 9 | −4 | 5 | 14 | 23 | 32 | 41 | 50 | 59 | 68 | 77 | 86 | 95 | 104 | 113 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | −55 TO −23 | −20 | −15 | −10 | −5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 49 |
| −1000 | | 1 & 3 | | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.05 | 2.00 | 1.96 | 1.92 |
| S.L. | | 1 & 3 | | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 |
| 1000 | | 1 & 3 | | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.13 | 2.12 | 2.12 | 2.11 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 | 2.15 | 2.13 | 2.13 | 2.12 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 |
| 2000 | | 1 & 3 | | 2.21 | 2.21 | 2.21 | 2.21 | 2.20 | 2.17 | 2.14 | 2.14 | 2.14 | 2.14 | 2.11 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | | 2.22 | 2.22 | 2.22 | 2.22 | 2.21 | 2.18 | 2.16 | 2.16 | 2.15 | 2.12 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 | |
| 3000 | | 1 & 3 | | 2.26 | 2.26 | 2.25 | 2.23 | 2.20 | 2.17 | 2.14 | 2.14 | 2.14 | 2.14 | 2.11 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | | 2.28 | 2.28 | 2.27 | 2.24 | 2.21 | 2.18 | 2.16 | 2.16 | 2.15 | 2.12 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 | |
| 3856 & ABOVE | | 1 & 3 | | 2.31 | 2.29 | 2.27 | 2.25 | 2.23 | 2.20 | 2.17 | 2.14 | 2.14 | 2.14 | 2.11 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | | 2.33 | 2.31 | 2.29 | 2.27 | 2.24 | 2.21 | 2.18 | 2.16 | 2.16 | 2.15 | 2.12 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 |

| EPR BLEED CORRECTIONS | ENG 1 & 3 | ENG 2 |
|---|---|---|
| AIR CONDITIONING | OFF + .04 | – |
| ENGINE ANTI-ICE ON | – | −.03 |

FIGURE 32.—Maximum Takeoff EPR.

The table below gives the approximate duration of the cabin oxygen system, based on a cylinder pressure of 1500 psi.

| CABIN ALTITUDE | NUMBER OF PASSENGERS | *APPROX. DURATION |
|---|---|---|
| 15,000 | 50 | 2 hrs. 29 mins. |
| | 75 | 1 hr. 39 mins. |
| | 110 | 1 hr. 12 mins. |
| | 140 | 1 hr. 2 mins. |
| | 170 | 53 mins. |
| 20,000 | 50 | 1 hr. 17 mins. |
| | 75 | 51 mins. |
| | 110 | 37 mins. |
| | 140 | 32 mins. |
| | 170 | 27 mins. |
| 25,000 | 50 | 50 mins. |
| | 75 | 33 mins. |
| | 110 | 24 mins. |
| | 140 | 20 mins. |
| | 170 | 18 mins. |

*For cylinder pressures less than 1500 psi, reduce duration by 8% for each 100 psi.

FIGURE 33.—Cabin Oxygen Duration.

## INFLIGHT ENGINE START ENVELOPE

| IAS KNOTS | | PRESSURE ALTITUDE 1000 FT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| $V_{MO}/M_{MO}$ | $N_1$% | 18 | 20 | 22 | 23 | 25 | 26 | 26 | 26 | 27 |
| | $N_2$% | 27 | 29 | 32 | 34 | 37 | 37 | 35 | 34 | 33 |
| 400 | | | | | 23 | 25 | | | | |
| | | | | | 34 | 36 | | | | |
| 380 | | 18 | 19 | 21 | 22 | 24 | 26 | | | |
| | | 27 | 28 | 30 | 32 | 34 | 37 | | | |
| 360 | | 17 | 18 | 20 | 21 | 23 | 25 | | | |
| | | 25 | 27 | 28 | 30 | 32 | 34 | | | |
| 340 | | 16 | 17 | 19 | 20 | 21 | 24 | 26 | | |
| | | 24 | 25 | 27 | 28 | 30 | 33 | 35 | | |
| 320 | | 15 | 16 | 18 | 19 | 20 | 22 | 25 | | |
| | | 22 | 23 | 25 | 27 | 28 | 31 | 33 | | |
| 300 | | 14 | 16 | 17 | 18 | 19 | 21 | 23 | 26 | |
| | | 21 | 22 | 23 | 25 | 27 | 29 | 31 | 33 | |
| 280 | | 13 | 15 | 16 | 17 | 18 | 20 | 22 | 24 | |
| | | 19 | 20 | 22 | 23 | 25 | 27 | 29 | 31 | |
| 260 | | 13 | 14 | 15 | 16 | 17 | 18 | 20 | 22 | 26 |
| | | 18 | 19 | 20 | 21 | 23 | 25 | 26 | 29 | 31 |
| 240 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 20 | 23 |
| | | 17 | 17 | 18 | 19 | 21 | 23 | 24 | 26 | 29 |
| 220 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 20 |
| | | 15 | 16 | 17 | 18 | 19 | 21 | 22 | 24 | 26 |

NOMINAL WINDMILLING RPM
TOLERANCE ± 3%

FIGURE 34.—In-Flight Engine Start.

## MAX TAKEOFF EPR

| DRY | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OAT | °F | −58 | −40 | −31 | −22 | −13 | − 4 | 5 | 14 | 23 | 32 | 41 | 50 | 59 | 68 | 77 | 86 | 95 | 104 | 122 |
| | | °C | −50 | −40 | −35 | −30 | −25 | −20 | −15 | −10 | −5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 50 |
| E | T/C | ON | 2.07 | 2.05 | 2.04 | 2.03 | 2.02 | 2.01 | 1.99 | 1.98 | 1.96 | 1.93 | 1.89 | 1.87 | 1.83 | 1.83 | 1.83 | 1.82 | 1.77 | 1.73 | 1.63 |
| P | | OFF | 2.12 | 2.10 | 2.09 | 2.08 | 2.06 | 2.05 | 2.03 | 2.01 | 1.99 | 1.96 | 1.92 | 1.89 | 1.85 | 1.85 | 1.85 | 1.84 | 1.79 | 1.75 | 1.65 |
| R | T/C | ON | 2.06 | | | 2.02 | | | 1.98 | | 1.93 | | 1.88 | | 1.83 | | | 1.78 | | | |
| | | OFF | 2.11 | | | 2.08 | | | 2.01 | | 1.96 | | 1.91 | | 1.85 | | | 1.80 | | | |
| 40 TO 80 KTS | | | 5000 | | | 4000 | | | 3000 | | 2000 | | 1000 | | SL | | | −1000 | | | |
| ENG A/I ON OR OFF | | | | | | | | | | | | | | | | | | | | | |

MAX EPR FOR COLDER TEMPS AT PRESS ALT

FIGURE 35.—Maximum Takeoff EPR.

**INFLIGHT ENGINE START ENVELOPE**

| IAS KNOTS | | PRESSURE ALTITUDE 1000 FT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| $V_{MO}/M_{MO}$ | $N_1\%$<br>$N_2\%$ | 18<br>27 | 20<br>29 | 22<br>32 | 23<br>34 | 25<br>37 | 26<br>37 | 26<br>35 | 26<br>34 | 27<br>33 |
| 400 | | | | | 23<br>34 | 25<br>36 | | | | |
| 380 | | 18<br>27 | 19<br>28 | 21<br>30 | 22<br>32 | 24<br>34 | 26<br>37 | | | |
| 360 | | 17<br>25 | 18<br>27 | 20<br>28 | 21<br>30 | 23<br>32 | 25<br>34 | | | |
| 340 | | 16<br>24 | 17<br>25 | 19<br>27 | 20<br>28 | 21<br>30 | 24<br>33 | 26<br>35 | | |
| 320 | | 15<br>22 | 16<br>23 | 18<br>25 | 19<br>27 | 20<br>28 | 22<br>31 | 25<br>33 | | |
| 300 | | 14<br>21 | 16<br>22 | 17<br>23 | 18<br>25 | 19<br>27 | 21<br>29 | 23<br>31 | 26<br>33 | |
| 280 | | 13<br>19 | 15<br>20 | 16<br>22 | 17<br>23 | 18<br>25 | 20<br>27 | 22<br>29 | 24<br>31 | |
| 260 | | 13<br>18 | 14<br>19 | 15<br>20 | 16<br>21 | 17<br>23 | 18<br>25 | 20<br>26 | 22<br>29 | 26<br>31 |
| 240 | | 12<br>17 | 13<br>17 | 14<br>18 | 15<br>19 | 16<br>21 | 17<br>23 | 18<br>24 | 20<br>26 | 23<br>29 |
| 220 | | 11<br>15 | 12<br>16 | 13<br>17 | 14<br>18 | 15<br>19 | 16<br>21 | 17<br>22 | 18<br>24 | 20<br>26 |

**NOMINAL WINDMILLING RPM**
**Plus or Minus 3%**

FIGURE 36.—In-Flight Engine Start.

## NORMAL TAKEOFF THRUST

1. Determine Max EPR from the Maximum Takeoff Thrust table.
2. Using Assumed Temperature and MAX EPR, determine Normal EPR.

EPR is valid when set at 40 - 80 knots, two cabin compressors are on, blowaway jets are off.

| ASSUM TEMP °F | MAX EPR | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.86 | 1.87 | 1.89 | 1.90 | 1.91 | 1.93 | 1.95 | 1.96 | 1.97 | 1.99 | 2.00 | 2.01 |
| | NORMAL EPR | | | | | | | | | | | |
| 120 | 1.75 | 1.76 | 1.78 | 1.79 | 1.80 | 1.82 | 1.84 | 1.85 | 1.86 | 1.88 | 1.89 | 1.90 |
| 115 | 1.75 | 1.76 | 1.78 | 1.79 | 1.80 | 1.82 | 1.84 | 1.85 | 1.86 | 1.88 | 1.89 | 1.90 |
| 110 | 1.75 | 1.76 | 1.78 | 1.79 | 1.80 | 1.82 | 1.84 | 1.85 | 1.86 | 1.88 | 1.89 | 1.90 |
| 105 | 1.75 | 1.76 | 1.78 | 1.79 | 1.80 | 1.82 | 1.84 | 1.85 | 1.86 | 1.88 | 1.89 | 1.90 |
| 100 | 1.77 | 1.77 | 1.78 | 1.79 | 1.80 | 1.82 | 1.84 | 1.85 | 1.86 | 1.88 | 1.89 | 1.90 |
| 95 | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 | 1.82 | 1.84 | 1.85 | 1.86 | 1.88 | 1.89 | 1.90 |
| 90 | 1.82 | 1.82 | 1.82 | 1.82 | 1.82 | 1.82 | 1.84 | 1.85 | 1.86 | 1.88 | 1.89 | 1.90 |
| 85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.85 | 1.86 | 1.88 | 1.89 | 1.90 |
| 80 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.88 | 1.89 | 1.90 |
| 75 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.88 | 1.89 | 1.90 |
| 70 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.88 | 1.89 | 1.90 |
| 65 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.88 | 1.89 | 1.90 |
| 60 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.88 | 1.89 | 1.90 |
| 55 | 1.86 | 1.87 | 1.87 | 1.87 | 1.87 | 1.87 | 1.87 | 1.87 | 1.87 | 1.88 | 1.89 | 1.90 |
| 50 | 1.86 | 1.87 | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 | 1.90 |
| 45 | 1.86 | 1.87 | 1.89 | 1.90 | 1.91 | 1.91 | 1.91 | 1.91 | 1.91 | 1.91 | 1.91 | 1.91 |
| 40 | 1.86 | 1.87 | 1.89 | 1.90 | 1.91 | 1.93 | 1.93 | 1.93 | 1.93 | 1.93 | 1.93 | 1.93 |
| 35 | 1.86 | 1.87 | 1.89 | 1.90 | 1.91 | 1.93 | 1.95 | 1.95 | 1.95 | 1.95 | 1.95 | 1.95 |
| 30 | 1.86 | 1.87 | 1.89 | 1.90 | 1.91 | 1.93 | 1.95 | 1.96 | 1.96 | 1.96 | 1.96 | 1.96 |
| 25 | 1.86 | 1.87 | 1.89 | 1.90 | 1.91 | 1.93 | 1.95 | 1.96 | 1.97 | 1.97 | 1.97 | 1.97 |

### ADJUSTMENTS:

1. All cabin compressors off, add .01.
2. Rain removal on, subtract .01.

## MAXIMUM TAKEOFF THRUST

| OAT °F | PRESSURE ALTITUDE (1,000 feet) | | | | | |
|---|---|---|---|---|---|---|
| | SL | 1 | 2 | 3 | 4 | Above 4 |
| 75 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 |
| 70 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 |
| 65 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 |
| 60 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 |
| 55 | 1.86 | 1.87 | 1.87 | 1.87 | 1.87 | 1.87 |
| 50 | 1.86 | 1.89 | 1.89 | 1.89 | 1.89 | 1.89 |
| 47 | 1.86 | 1.90 | 1.90 | 1.90 | 1.90 | 1.90 |
| 45 | 1.86 | 1.90 | 1.91 | 1.91 | 1.91 | 1.91 |
| 40 | 1.86 | 1.90 | 1.93 | 1.93 | 1.93 | 1.93 |
| 35 | 1.86 | 1.90 | 1.95 | 1.95 | 1.95 | 1.95 |
| 33 | 1.86 | 1.90 | 1.95 | 1.95 | 1.95 | 1.95 |
| 30 | 1.86 | 1.90 | 1.95 | 1.96 | 1.96 | 1.96 |
| 25 | 1.86 | 1.90 | 1.95 | 1.97 | 1.97 | 1.97 |
| 20 | 1.86 | 1.90 | 1.95 | 1.99 | 1.99 | 1.99 |
| 16 | 1.86 | 1.90 | 1.95 | 2.00 | 2.00 | 2.00 |
| 15 | 1.86 | 1.90 | 1.95 | 2.00 | 2.01 | 2.01 |
| 10 | 1.86 | 1.90 | 1.95 | 2.00 | 2.02 | 2.02 |
| 5 | 1.86 | 1.90 | 1.95 | 2.00 | 2.03 | 2.03 |
| 0 | 1.86 | 1.90 | 1.95 | 2.00 | 2.04 | 2.04 |
| –5 | 1.86 | 1.90 | 1.95 | 2.00 | 2.05 | 2.05 |

FIGURE 37.—Normal/Maximum Takeoff Thrust.

## TAKEOFF SPEEDS

| ALT. – 1000 FT. | AMBIENT TEMPERATURE – °F |
|---|---|
| 6 to 7 | – – – |
| 5 to 6 | – – – |
| 4 to 5 | –20 to – 5 |
| 3 to 4 | –20 to 15 |
| 2 to 3 | –20 to 35 |
| 1 to 2 | –20 to 55 |
| 0 to 1 | –20 to 85 |
| | – – – |
| | –20 to 5 |
| | 5 to 25 |
| | 25 to 45 |
| | 45 to 85 |
| | 85 to 95 |
| | 5 to 25 |
| | 25 to 45 |
| | 45 to 85 |
| | 85 to 95 |
| | 95 to 105 |
| | 25 to 85 |
| | 45 to 95 |
| | 85 to 105 |
| | 95 to 105 |
| | 105 to 120 |
| | – – – |
| | 105 to 120 |
| | – – – |

| FLAP POS | WEIGHT – 1000 LBS. | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 325 | 140 | 154 | 162 | 141 | 154 | 161 | 142 | 154 | 161 | 144 | 155 | 161 | | | |
| | 320 | 138 | 153 | 160 | 139 | 153 | 160 | 141 | 153 | 160 | 143 | 154 | 160 | 145 | 154 | 160 |
| | 300 | 132 | 147 | 156 | 133 | 147 | 155 | 134 | 147 | 155 | 136 | 148 | 155 | 138 | 149 | 154 |
| | 280 V BASIC | 126 | 141 | 151 | 127 | 142 | 151 | 128 | 142 | 151 | 130 | 142 | 150 | 131 | 143 | 150 |
| | 260 | 119 | 135 | 147 | 120 | 136 | 146 | 121 | 136 | 146 | 123 | 137 | 145 | 124 | 138 | 145 |
| | 240 | 112 | 128 | 142 | 113 | 129 | 141 | 114 | 129 | 141 | 116 | 130 | 140 | 117 | 131 | 140 |
| | 220 | 106 | 122 | 135 | 107 | 123 | 136 | 108 | 124 | 136 | 109 | 124 | 135 | 110 | 125 | 134 |
| | 200 | 99 | 120 | 136 | 100 | 118 | 133 | 100 | 115 | 130 | 102 | 117 | 130 | 103 | 118 | 129 |
| | 180 | 108 | 120 | 138 | 104 | 118 | 134 | 102 | 114 | 130 | 98 | 110 | 126 | 95 | 111 | 124 |
| | $V_1$ Limit | 108 | – | – | 104 | – | – | 102 | – | – | 99 | – | – | – | – | – |
| 15 | 325 | 143 | 159 | 169 | 144 | 160 | 169 | 145 | 161 | 169 | 144 | 160 | 169 | | | |
| | 320 | 142 | 157 | 168 | 142 | 158 | 168 | 144 | 160 | 168 | 146 | 159 | 168 | 143 | 161 | 167 |
| | 300 V BASIC | 135 | 151 | 163 | 136 | 152 | 163 | 137 | 153 | 163 | 139 | 152 | 163 | 142 | 155 | 162 |
| | 280 | 129 | 145 | 158 | 129 | 146 | 158 | 131 | 147 | 158 | 132 | 146 | 157 | 135 | 149 | 157 |
| | 260 | 122 | 139 | 153 | 123 | 140 | 153 | 124 | 141 | 153 | 125 | 140 | 153 | 128 | 142 | 152 |
| | 240 | 115 | 132 | 148 | 116 | 133 | 148 | 117 | 134 | 148 | 118 | 134 | 147 | 121 | 136 | 146 |
| | 220 | 109 | 125 | 143 | 109 | 126 | 143 | 110 | 127 | 143 | 111 | 127 | 142 | 113 | 129 | 140 |
| | 200 | 108 | 120 | 140 | 102 | 119 | 137 | 103 | 120 | 137 | 104 | 119 | 136 | 106 | 122 | 135 |
| | 180 | 108 | 120 | 143 | 104 | 118 | 139 | 95 | 116 | 134 | 96 | 113 | 131 | 98 | 114 | 129 |
| | $V_1$ Limit | 108 | – | – | 104 | – | – | 102 | – | – | 99 | – | – | – | – | – |

Compare adjusted $V_1$ Basic speed with $V_1$ Limit speed and use the higher speed.

### ADJUSTMENTS:

1. Headwind: For each 15 knots, increase $V_1$ Basic 1 knot.
2. Tailwind: For each 5 knots, decrease $V_1$ Basic 1 knot.
3. Airports BOS R/W 17, TAS R/W 1 & 7, SEA R/W 16, decrease $V_1$ Basic 3 knots.
4. Airports BOS R/W 35, TAS R/W 19 & 25, SEA R/W 34, increase $V_1$ Basic 3 knots.

FIGURE 38.—Takeoff Speeds.

| OPERATING CONDITIONS | 1 | 2 | 3 |
|---|---|---|---|
| ORIGINAL WEIGHT | 155,000 | 130,500 | 100,350 |
| ORIGINAL CG - %MAC | 29.5 | 20.8 | 24.6 |
| LENGTH OF MAC | 164.5 | 164.5 | 164.5 |
| LEMAC | TS-39.6 | TS-39.6 | TS-39.6 |
| WEIGHT REMOVED | 7,500 | 9,600 | 12,500 |
| LOCATION OF WEIGHT REMOVED | TS+239.5 | TS-120 | TS-30 |
| NOTE: STA 527.0 = TRIM STA (TS) 0.0 | | | |

FIGURE 39.—CG Shift.

| OPERATING CONDITIONS | 1 | 2 | 3 |
|---|---|---|---|
| BASIC OPERATING WEIGHT (BOW) | 70,500 | 70,450 | 69,800 |
| BOW CG - %MAC | 25.0 | 23.5 | 20.4 |
| CARGO | | | |
| COMPT A (TS-299.5) | 1,000 | 3,000 | 3,000 |
| COMPT B (TS-210) | 2,000 | 4,500 | 5,500 |
| COMPT C (TS-120) | 3,500 | 5,500 | 6,500 |
| COMPT D (TS-30) | 3,500 | 6,500 | 7,500 |
| COMPT E (TS+60) | 2,500 | 6,500 | 7,000 |
| COMPT F (TS+150) | 2,500 | 6,000 | 6,500 |
| COMPT G (TS+239.5) | 1,000 | 6,000 | 6,000 |
| FUEL AVG STA 555.0 | 30,000 | 42,000 | 43,000 |
| NOTE: STA 527.0 = TRIM STA (TS) 0.0<br>MAC 164.5", LEMAC 487.4 (TS-39.6) | | | |

FIGURE 40.—CG in Percent of MAC.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| TAKEOFF WEIGHT | | 155,000 | 133,330 | 100,100 |
| ORIGINAL CG - | %MAC | 21.9 | 31.5 | 16.5 |
| AFFECTED CG LIMIT | %MAC | 23.2 | 30.0 | 18.4 |
| CARGO LOCATIONS | FWD TS | -120 | -30 | -210 |
| | AFT TS | +150 | +239.5 | +60 |
| MAC 164.5, LEMAC TS -39.6, TS 0 = STA 537.0 | | | | |

FIGURE 41.—Cargo Shift.

| OPERATING CONDITIONS | 1 | 2 | 3 |
|---|---|---|---|
| BASIC OPERATING WEIGHT | 70,500 | 72,400 | 69,700 |
| MAXIMUM ZERO FUEL WEIGHT | 125,000 | 126,790 | 126,790 |
| MAXIMUM LANDING WEIGHT | 130,000 | 135,000 | 135,000 |
| MAXIMUM TAKEOFF WEIGHT | 155,000 | 155,000 | 155,000 |
| FUEL TANK LOAD | 60,500 | 41,610 | 35,300 |
| ESTIMATED FUEL BURN | 41,200 | 20,440 | 15,910 |

FIGURE 42.—Maximum Payload.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| GROSS WEIGHT | LB | 140,000 | 115,000 | 145,000 |
| PRESSURE ALTITUDE | FT | 16,000 | 20,000 | 5,000 |
| AMBIENT TEMPERATURE | °C | -32 | -5 | +20 |
| CRUISE TIME | HR | 4.0 | 3.5 | 2.5 |

FIGURE 43.—Cruise Weight Change.

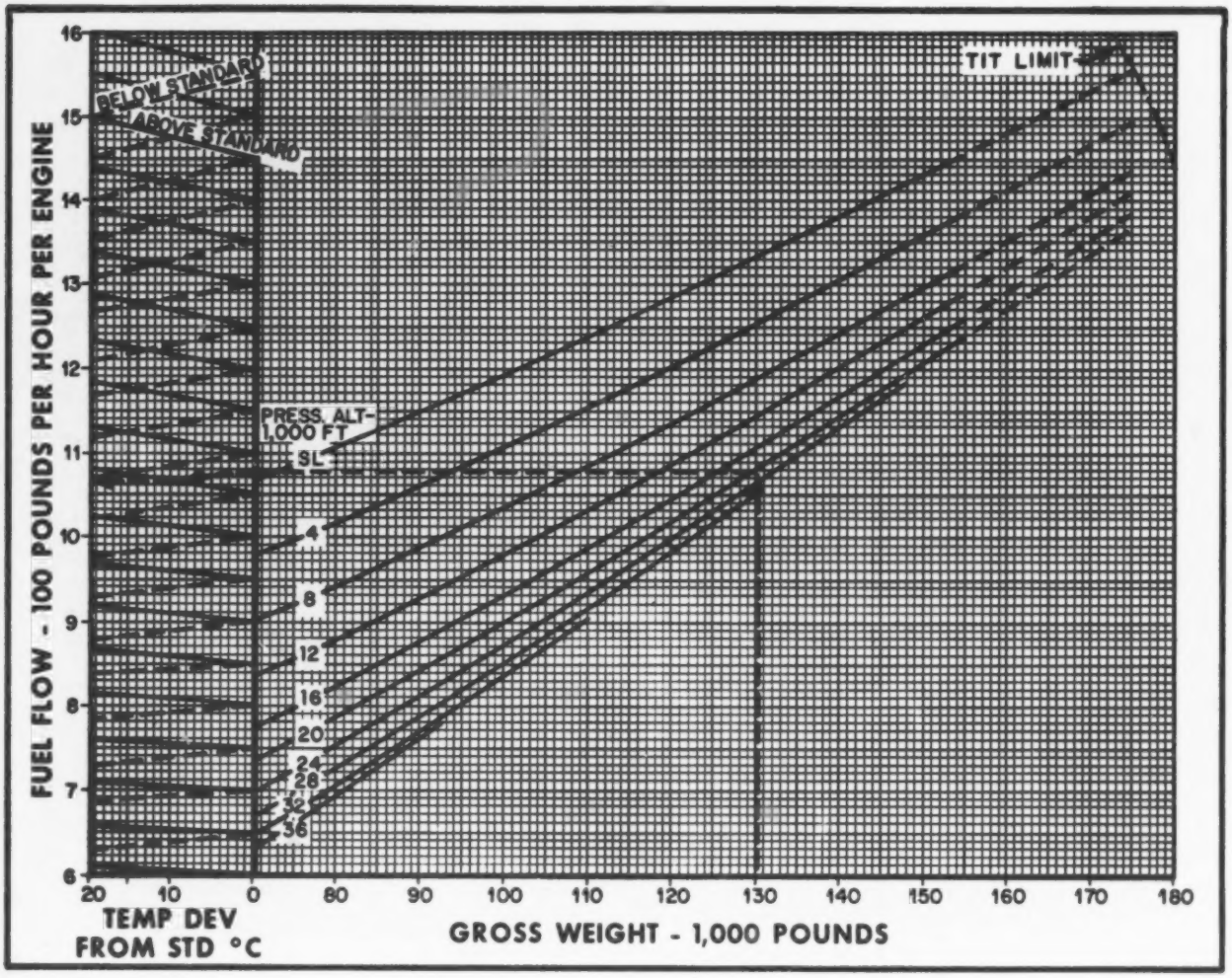



FIGURE 44.—Gross Weight Table.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| PRESSURE ALTITUDE | FT | 1,000 | 10,000 | 1,500 |
| CAS | KT | 100 | 140 | 120 |
| AMBIENT TEMPERATURE | °C | 0 | -10 | -30 |

FIGURE 45.—Torque Requirement Conditions.

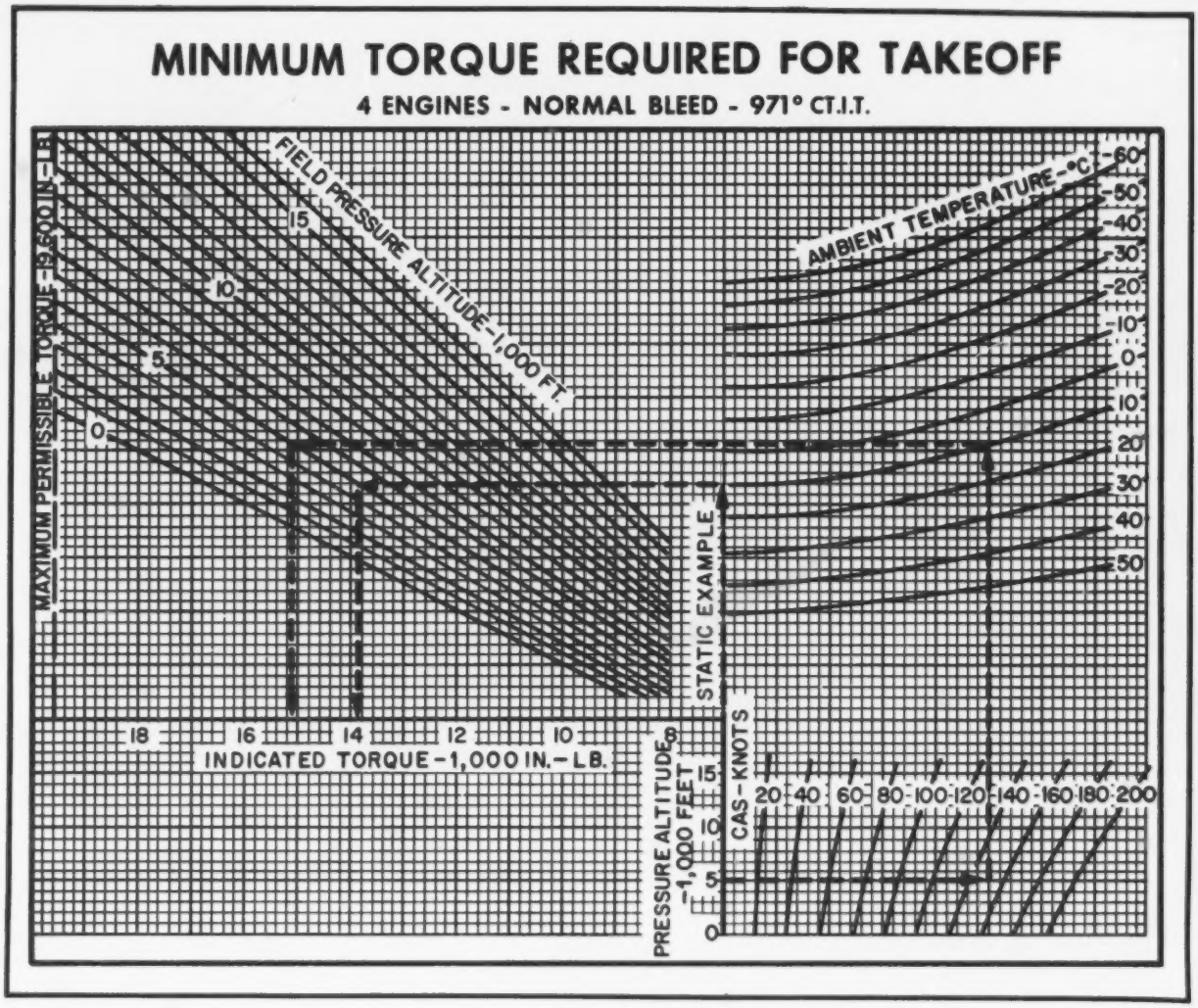



FIGURE 46.—Minimum Takeoff Torque.

| OPERATING CONDITIONS | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| NAM/1,000 | LB | 55.4 | 62.0 | 67.2 | 72.5 |
| TAS | KT | 200 | 220 | 240 | 260 |
| WIND COMPONENT | KT | 10 HW | 10 TW | 20 HW | 20 TW |
| CRUISE TIME | HR | 4.0 | 4.5 | 5.0 | - |

FIGURE 47.—Fuel Burn Conditions.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| DEPARTURE AIRPORT ELEVATION | FT | 1,000 | 2,000 | 1,500 |
| PRESSURIZATION START ABOVE AIRPORT | FT | 500 | 1,000 | - |
| CRUISING ALTITUDE | FT | 20,000 | 22,000 | 25,000 |
| DESIRED CABIN ALTITUDE | FT | 8,000 | 7,000 | 8,000 |
| AIRCRAFT RATE OF CLIMB | FT/MIN | 750 | 800 | 1,900 |

FIGURE 48.—Cabin Rate of Climb.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| BASIC OPERATING WEIGHT | (BOW) | 61,310 | 62,700 | 59,340 |
| BOW CG - | %MAC | 24.0 | 15.5 | 26.5 |
| PASSENGERS | FWD (STA 300.0) | 2,890 | 1,700 | 2,550 |
| | AFT (STA 654.0) | 12,070 | 8,500 | 10,540 |
| CARGO | FWD (STA 313.0) | 500 | 3,800 | 1,000 |
| | AFT (STA 885.0) | 700 | 1,000 | 100 |
| FUEL 1 AND 4 | (STA 605.7) | 7,300 EA | 7,370 EA | 10,500 EA |
| FUEL 2 AND 3 | (STA 628.4) | 7,300 EA | 11,122 EA | 10,500 EA |
| MAC | 168.7 | | | |
| LEMAC | 545.9 | | | |

FIGURE 49.—Loading Conditions.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| ORIGINAL WEIGHT | | 100,000 | 102,500 | 98,700 |
| ORIGINAL CG - | %MAC | 13.1 | 28.7 | 17.6 |
| LENGTH OF MAC - | %MAC | 168.7 | 168.7 | 168.7 |
| LEMAC - | STA | 545.9 | 545.9 | 545.9 |
| WEIGHT ADDED | | 3,500 | 3,650 | 4,000 |
| LOCATION ADDED - | STA | 885.0 | 313.0 | 885.0 |

FIGURE 50.—CG Position Change.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| TAKEOFF WEIGHT | | 113,000 | 106,000 | 110,500 |
| ORIGINAL CG - | %MAC | 20.5 | 33.5 | 19.9 |
| LENGTH OF MAC | | 168.7 | 168.7 | 168.7 |
| LEMAC | | 545.9 | 545.9 | 545.9 |
| AFFECTED CG LIMIT | %MAC | 22.0 | 32.0 | 21.8 |
| CARGO LOCATIONS | FWD | 313.0 | 313.0 | 313.0 |
| | AFT | 885.0 | 885.0 | 885.0 |

FIGURE 51.—Cargo Shift Conditions.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| PRESSURE ALTITUDE | FT | 1,000 | 10,000 | 2,500 |
| CAS | KT | 100 | 120 | 140 |
| AMBIENT TEMPERATURE | °C | +10 | -10 | +10 |

FIGURE 52.—Takeoff Power Conditions.

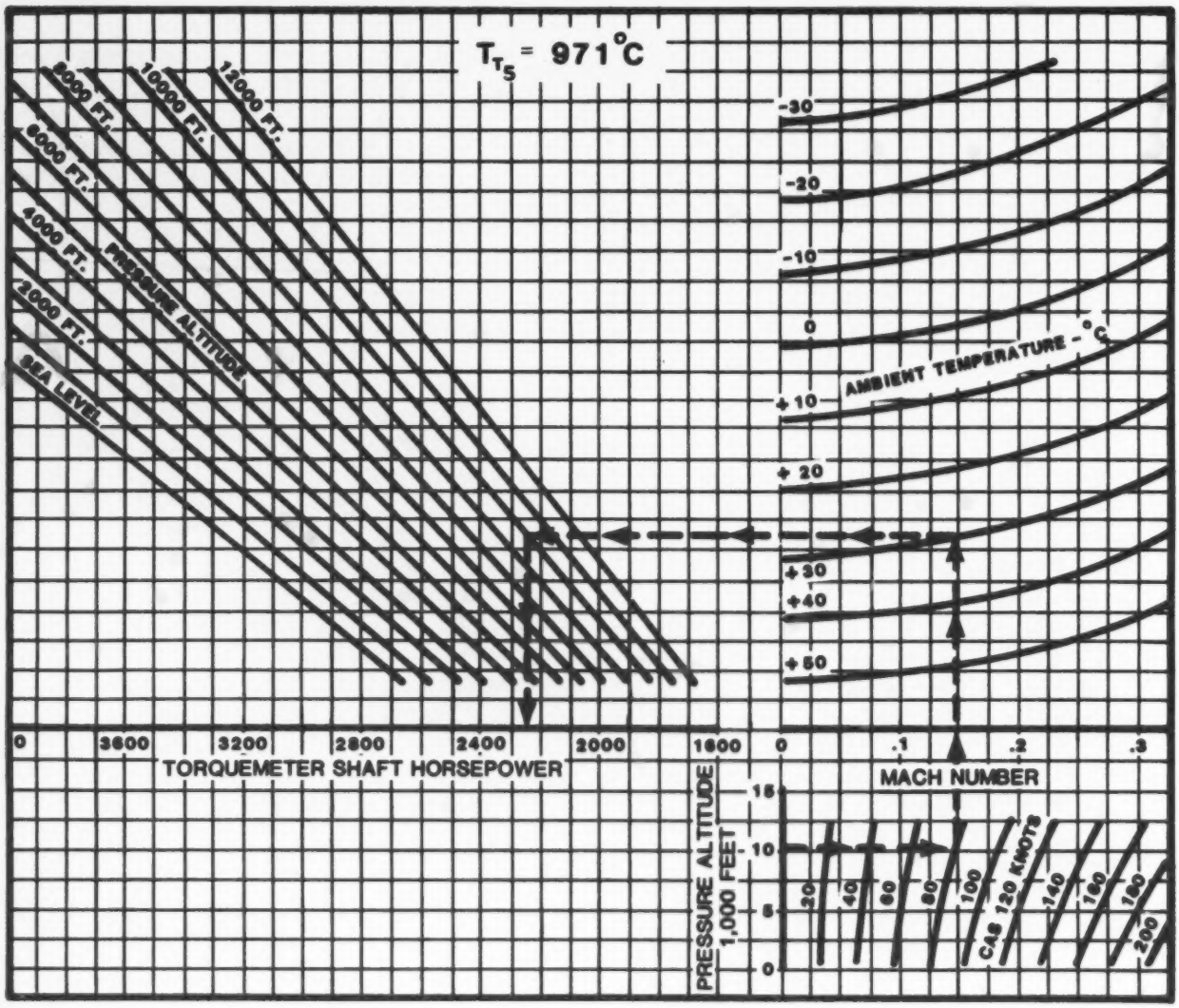



FIGURE 53.—Takeoff Power Conditions.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| CRUISE ALTITUDE | FT | 19,000 | 17,000 | 23,000 |
| AMBIENT TEMPERATURE | °C | -13 | -19 | -41 |
| WEIGHT START CRUISE | LB | 105,000 | 110,000 | 115,000 |
| CRUISE TIME | HR | 3.5 | 3.5 | 2.5 |
| DESCENT AND LANDING FUEL BURN | LB | 1,350 | 1,200 | 1,550 |

FIGURE 54.—Landing Weight Conditions.

## STD. + 10°C

GROSS WEIGHT - POUNDS

| PRESS ALT-1000 FT | 25 | 23 | 21 | 19 | 17 | 15 | 13 | 11 | 9 | 7 | 5 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115,000 | | | | 321 | 323 | 324 | 325 | 324 | 323 | 322 | 320 | 319 |
| | | | | 4210 | 4440 | 4690 | 4930 | 5170 | 5410 | 5660 | 5920 | 6170 |
| 110,000 | | | 322 | 324 | 326 | 326 | 327 | 326 | 325 | 324 | 322 | 320 |
| | | | 3990 | 4220 | 4460 | 4700 | 4950 | 5180 | 5420 | 5680 | 5930 | 6180 |
| 105,000 | | | 325 | 327 | 328 | 329 | 328 | 328 | 327 | 325 | 323 | 321 |
| | | | 4000 | 4230 | 4470 | 4710 | 4960 | 5190 | 5440 | 5690 | 5940 | 6190 |
| 100,000 | | 327 | 329 | 330 | 331 | 331 | 330 | 329 | 328 | 326 | 324 | 322 |
| | | 3780 | 4010 | 4240 | 4480 | 4720 | 4970 | 5200 | 5450 | 5700 | 5950 | 6200 |
| 95,000 | 328 | 330 | 331 | 332 | 333 | 332 | 332 | 331 | 329 | 327 | 325 | 323 |
| | 3580 | 3790 | 4020 | 4250 | 4490 | 4730 | 4970 | 5200 | 5450 | 5710 | 5960 | 6200 |
| 90,000 | 332 | 333 | 334 | 335 | 335 | 334 | 333 | 332 | 330 | 328 | 326 | 324 |
| | 3590 | 3800 | 4020 | 4250 | 4490 | 4730 | 4970 | 5210 | 5460 | 5710 | 5960 | 6210 |
| 85,000 | 335 | 336 | 337 | 337 | 337 | 336 | 335 | 333 | 331 | 329 | 327 | 325 |
| | 3600 | 3800 | 4030 | 4250 | 4500 | 4730 | 4980 | 5220 | 5470 | 5720 | 5970 | 6210 |
| 80,000 * | 338 | 339 | 339 | 339 | 338 | 337 | 336 | 334 | 332 | 330 | 328 | 325 |
| ** | 3600 | 3800 | 4030 | 4260 | 4500 | 4740 | 4980 | 5220 | 5470 | 5730 | 4970 | 6220 |

## STD. DAY

GROSS WEIGHT - POUNDS

| PRESS ALT-1000 FT | 25 | 23 | 21 | 19 | 17 | 15 | 13 | 11 | 9 | 7 | 5 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115,000 | | | 331 | 333 | 335 | 335 | 336 | 335 | 333 | 332 | 331 | 329 |
| | | | 4280 | 4530 | 4800 | 5050 | 5320 | 5590 | 5850 | 6100 | 6400 | 6690 |
| 110,000 | | 331 | 334 | 336 | 337 | 337 | 337 | 336 | 335 | 334 | 332 | 330 |
| | | 4060 | 4290 | 4540 | 4800 | 5050 | 5320 | 5600 | 5870 | 6110 | 6410 | 6700 |
| 105,000 | 331 | 335 | 337 | 338 | 339 | 339 | 339 | 338 | 336 | 335 | 333 | 331 |
| | 3840 | 4070 | 4290 | 4540 | 4810 | 5060 | 5330 | 5600 | 5880 | 6120 | 6420 | 6710 |
| 100,000 | 335 | 338 | 340 | 340 | 341 | 341 | 340 | 339 | 337 | 336 | 334 | 332 |
| | 3850 | 4080 | 4300 | 4550 | 4810 | 5070 | 5330 | 5610 | 5890 | 6130 | 6430 | 6710 |
| 95,000 | 339 | 341 | 342 | 342 | 343 | 342 | 341 | 340 | 338 | 337 | 335 | 333 |
| | 3850 | 4080 | 4310 | 4550 | 4820 | 5070 | 5340 | 5610 | 5890 | 6140 | 6440 | 6720 |
| 90,000 | 342 | 343 | 344 | 344 | 344 | 343 | 342 | 341 | 340 | 338 | 336 | 333 |
| | 3860 | 4090 | 4320 | 4560 | 4820 | 5080 | 5340 | 5620 | 5900 | 6150 | 6450 | 6730 |
| 85,000 | 344 | 345 | 346 | 346 | 346 | 345 | 343 | 342 | 340 | 339 | 336 | 334 |
| | 3870 | 4090 | 4320 | 4570 | 4830 | 5080 | 5350 | 5620 | 5910 | 6150 | 6450 | 6740 |
| 80,000 * | 348 | 348 | 348 | 348 | 347 | 346 | 345 | 343 | 341 | 339 | 337 | 335 |
| ** | 3880 | 4100 | 4330 | 4570 | 4830 | 5090 | 5350 | 5630 | 5910 | 6160 | 6460 | 6740 |

## STD. − 10°C

GROSS WEIGHT - POUNDS

| PRESS ALT-1000 FT | 25 | 23 | 21 | 19 | 17 | 15 | 13 | 11 | 9 | 7 | 5 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115,000 | | 338 | 341 | 343 | 344 | 344 | 344 | 343 | 343 | 342 | 340 | 333 |
| | | 4340 | 4620 | 4890 | 5170 | 5450 | 5740 | 6030 | 6320 | 6620 | 6920 | 7030 |
| 110,000 | 338 | 341 | 344 | 345 | 346 | 346 | 346 | 345 | 344 | 343 | 341 | 333 |
| | 4070 | 4350 | 4630 | 4900 | 5180 | 5460 | 5750 | 6040 | 6330 | 6630 | 6930 | 7000 |
| 105,000 | 342 | 345 | 346 | 347 | 347 | 347 | 347 | 346 | 345 | 344 | 342 | 333 |
| | 4080 | 4360 | 4640 | 4910 | 5190 | 5470 | 5760 | 6050 | 6340 | 6640 | 6940 | 6980 |
| 100,000 | 345 | 347 | 349 | 349 | 349 | 349 | 348 | 347 | 346 | 345 | 343 | 333 |
| | 4090 | 4370 | 4650 | 4920 | 5200 | 5480 | 5770 | 6060 | 6340 | 6640 | 6940 | 6960 |
| 95,000 | 348 | 350 | 351 | 351 | 351 | 350 | 350 | 348 | 347 | 346 | 343 | 333 |
| | 4100 | 4380 | 4650 | 4920 | 5210 | 5480 | 5770 | 6060 | 6350 | 6650 | 6920 | 6940 |
| 90,000 | 350 | 352 | 353 | 353 | 352 | 352 | 351 | 350 | 348 | 347 | 343 | 333 |
| | 4110 | 4380 | 4660 | 4930 | 5210 | 5490 | 5780 | 6060 | 6350 | 6650 | 6900 | 6930 |
| 85,000 | 353 | 354 | 355 | 355 | 354 | 353 | 352 | 350 | 349 | 347 | 343 | 333 |
| | 4120 | 4380 | 4660 | 4930 | 5220 | 5500 | 5780 | 6060 | 6360 | 6660 | 6880 | 6910 |
| 80,000 * | 355 | 356 | 356 | 356 | 355 | 354 | 353 | 351 | 350 | 348 | 343 | 333 |
| ** | 4120 | 4390 | 4660 | 4930 | 5220 | 5500 | 5780 | 6060 | 6360 | 6660 | 6870 | 6900 |

*True Airspeed - Knots
**Four Engine Fuel Flow - Lbs/Hr

FIGURE 55.—Cruise Chart.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| DEPARTURE AIRPORT ELEVATION | FT | 1,000 | 2,000 | 1,500 |
| PRESSURIZATION START ABOVE AIRPORT | FT | 500 | 1,000 | - |
| CRUISING ALTITUDE | FT | 20,000 | 22,000 | 25,000 |
| DESIRED CABIN ALTITUDE | FT | 8,000 | 7,000 | 8,000 |
| AIRCRAFT RATE OF CLIMB | FT/MIN | 750 | 800 | 1,900 |

FIGURE 56.—Cabin Altitude Conditions.

| OPERATING CONDITIONS | 1 | 2 | 3 |
|---|---|---|---|
| BASIC OPERATING WEIGHT | 58,000 | 57,700 | 58,750 |
| MAXIMUM ZERO FUEL WEIGHT | 83,200 | 83,200 | 83,200 |
| MAXIMUM LANDING WEIGHT | 88,200 | 88,200 | 88,200 |
| MAXIMUM TAKEOFF WEIGHT | 103,000 | 103,000 | 103,000 |
| FUEL TANK LOAD | 23,500 | 19,200 | 17,000 |
| ESTIMATED FUEL BURN | 17,625 | 16,700 | 8,050 |

FIGURE 57.—Maximum Payload Conditions.

| OPERATING CONDITIONS | | 1 | 2 | 3 |
|---|---|---|---|---|
| TAKEOFF WEIGHT | | 103,000 | 98,200 | 88,200 |
| ORIGINAL CG | %MAC | 10.4 | 34.5 | 9.5 |
| AFFECTED CG LIMIT | %MAC | 11.0 | 33.0 | 11.0 |
| MAC 163.6, LEMAC 395.2, FWD CARGO 185.0, AFT CARGO 715.0 | | | | |

FIGURE 58.—Cargo Shift Conditions.